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CALIFORNIA MANAGEMENT REVIEW

Volume II, Number 4 Summer, 1960

in this issue

turn to the next page for more about the articles . . . more about the authors→

the authors and the articles . . .

9 HOW ASPIRING MANAGERS PROMOTE THEIR OWN CAREERS

Why do some young men in business progress rapidly to top management jobs while others, with the same educational background, reach a stalemate? The decisive factor, according to this article, lies in the young businessman's strategy in the "game" he plays with his company.

• WILLIAM R. DILL is Associate Professor of Industrial Administration and Assistant Dean at the Graduate School of Industrial Administration, Carnegie Institute of Technology. His interest in management development training has carried over into a general concern with how executives make decisions and how their behavior is affected by the organizational environment in which they work.

• THOMAS L. HILTON, an Assistant Professor of Psychology and Education at Carnegie Institute of Technology, has been interested mainly in career-development research, particularly regarding the factors which influence men to select certain occupational roles and to perform the roles with vigor and efficiency.

• WALTER R. REITMAN is a psychologist studying complex information processing in human beings and computers. He is an Associate Professor of Psychology and Industrial Administration at the Graduate School of Industrial Administration, Carnegie Institute of Technology, where he teaches courses in psychology and human relations.

16 WHAT EVERY BUSINESSMAN SHOULD KNOW ABOUT THE ANTITRUST LAWS

Because a knowledge of antitrust laws is important to every businessman, here is a quick but definitive sizing up of the judicial opinions, rendered in court trials, which give breadth and scope to our nation's antitrust policies.

• VICTOR R. HANSEN has had an illustrious career as a lawyer, judge, and administrator. Having served as Assistant Attorney General of the United States in charge of the Antitrust Division, Department of Justice (1956–1959), his knowledge of the antitrust laws is outstanding. He has also served as Judge of the Superior Court of Los Angeles County and Adjutant General of the State of California. He has been Brigadier General of the California National Guard since 1944 and a Regent of the University of California since 1946. He was awarded the Dicksen Alumni Award, University of California, Los Angeles, in 1950. He is currently a partner in the Los Angeles law firm of Hansen & Dolle.

the authors and the articles . . .

THE OUTLOOK FOR CANADIAN GROWTH IN THE EARLY 1960's 24

The external stimuli which have operated on Canada's burgeoning economy in the years since World War II may not be as strong during the 1960's. Can Canada "go it alone" for awhile, or is she in for a period of serious stagnation?

• RICHARD H. HOLTON is Associate Professor of Business Administration and Director of the Bureau of Business and Economic Research at the University of California, Berkeley. He is co-author, with Richard E. Caves, Associate Professor of Economics at Berkeley, of *The Canadian Economy, Prospect and Retrospect,* published in 1959 as one of the Harvard Economic Studies. He did research work in Puerto Rico and taught economics at Ohio State University and Harvard University before accepting his position at Berkeley.

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QUANTITATIVE METHODS IN R & D MANAGEMENT 36

A pioneer in the application of quantitative techniques to R&D management surveys the results of the latest and most important work in this new field.

• RAOUL J. FREEMAN is Project Director at General Analysis Corporation, Los Angeles. His work with the company is concerned with the analysis of intelligence systems, gaming and simulation, economic analysis, and various commerical applications of operations research in a management consulting capacity. He is also on the faculty of the Graduate School of Business Administration, University of California, Los Angeles. He was the first recipient of the Ramo-Wooldridge Fellowship in Systems Engineering at the Massachusetts Institute of Technology, and is the author of several articles in the field of R&D management.

WHY THE BRITISH SHELVED COMPULSORY ARBITRATION 45

Talk about the possibility of introducing compulsory arbitration in the U. S. to solve labor disputes still rages. As this article points out, Americans could learn a good lesson from the British on this matter.

• ERIC G. A. ARMSTRONG is a native of England with years of experience in industrial law and industrial relations. He is currently serving on the faculty of the School of Business, Indiana University, as part of a program sponsored by the European Productivity Agency. In England, he studied at the University of Birmingham and later served as a lecturer there in the College of Technology. He has had six years' industrial experience in wage and salary policy administration.

the authors and the articles . . .

54 THE GROWING CONCERN OVER BUSINESS RESPONSIBILITY

The values that determined business responsibility in the past are gone. Somehow, we must set up a new standard by which businessmen can evaluate their obligations to their company and to society. This article sets forth the basis for the new standard.

• WILLIAM C. FREDERICK is Associate Professor of Management and Economics in the School of Business Administration, University of Kansas City. He has done extensive research in social anthropology and its application to economic and management problems. In past years, he served on the faculties of the University of Texas, University of Florida, and University of Tampa; and since 1958, he has assisted in instituting a modern program of management education at the University of Kansas City.

62 METHODS FOR FORECASTING CONSUMER DEMAND FOR SPECIFIC PRODUCTS

Those who must do short-range forecasting such as is typically required for inventory control will be interested in this technical explanation of quick and economical ways to forecast consumer demand for specific products.

• FRANCIS W. DRESCH is Manager of the Industrial Operations Research and Electronic Data Processing group of the Division of Economics, Stanford Research Institute. In the past, he served as Assistant Director, and then Director of Computation and Ballistics, at the United States Naval Proving Ground, Dahlgren, Virginia. He has studied at Stanford University and in England and France. He also has written several papers and reviews dealing with econometrics and mathematics.

73 THE STAGGERING PROBLEMS IN MANAGING NATIONAL DEFENSE

The inconsistencies and fluctuations in our national defense program create major headaches for businessmen who must adjust company operations to keep in step. Why can't the program be cohesive? This article will tell you.

• EDWIN B. GEORGE is nationally prominent in the fields of government and finance. He is now Chairman of the Program Advisory Committee, Office of Civil and Defense Mobilization, as well as Director of Economics, Dun & Bradstreet, Inc., and Contributing Editor of *Dun's Review* and *Modern Industry*. His positions with the U. S. Government have included American Trade Commissioner to Far Eastern Countries; Chief, Domestic Commerce Division, Department of Commerce; Director, Review and Analysis Staff, War Production Board; Assistant, and later, Consultant to Chairman of the War Production Board; Consultant to Congressional Committee on Foreign Aid; and Assistant to Director of Defense Mobilization.

the authors and the articles . . .

HOW TO FORECAST DEFENSE EXPENDITURES 84

If your business needs a long-range projection of military expenditures, this article explains a tested method which your staff can use to forecast defense budgets. It will also explain to you, the manager, what you should and should not expect from such forecasts.

• GEORGE A. STEINER is Director of the Division of Research, Graduate School of Business Administration, University of California, Los Angeles. He has held top-level positions in industry and government, including those of Senior Economic Advisor, Development and Planning, at Lockheed Aircraft Corporation, and Director of Policy Development for the Defense Production Administration and Office of Defense Mobilization. He has written extensively on a variety of economic and management problems.

How Aspiring Managers Promote Their Own Careers

WILLIAM R. DILL, THOMAS L. HILTON, and WALTER R. REITMAN

If your own career seems to be standing still, perhaps it is because your strategy is faulty, not your work. Read how successful businessmen act as agents of their own progress.

Few studies that deal with executive development focus on the early progress of those who aspire to managerial jobs in industry. Fewer still have focused on the process by which young men move ahead. Studies of the social origins of business leaders, for example, describe the importance of social and educational advantages; but they have little to say about the ways in which men with social and educational advantages move from their initial assignments in industry to top managerial posts.[1] Retrospective studies of how mature executives have achieved success are only as good as the executives' memories and understanding of events that took place fifteen to forty years earlier; and because these studies deal with the past, they have limited pertinence in trying to anticipate the careers of young men who are now entering management.[2] Psychometric studies of the personal characteristics of successful executives too often are content with correlations and are cautious in raising questions about process.[3]

Efforts to analyze early career progress are still in the speculative, exploratory stage. Martin and Strauss report on the importance of the "sponsorship" process.[4] The young man who wants to get ahead should make himself indispensable to someone higher in management who is already on the way to the top. Dalton and Coates and Pellegrin present data that serve as persuasive testimony of the role of informal, unpublicized variables (such as religion, nationality, and fraternal organization memberships) in promotion decisions.[5] Riesman, Whyte, and Argyris have argued that too often the road to success in American industry is through conformity and subservience to the organization rather than through creative, autonomous thought and action.[6]

[1] See, for example, such diverse sources as W. Warner and J. Abbegglen, *Occupational Mobility in American Business and Industry* (Minneapolis, 1955); R. Bendix and F. Howton, "Social Mobility and the American Business Elite," in S. M. Lipset and R. Bendix, *Social Mobility in Industrial Society* (Berkeley, 1959), pp. 114–143; and S. J. Kaplan, "Up from the Ranks on a Fast Escalator," *American Sociological Review*, 24 (1959), pp. 79–81.

[2] The rapidity with which changes in the job of management are occurring is reflected in two recent books, R. A. Gordon and J. E. Howell, *Higher Education for Business* (New York, 1959) and R. C. Pierson, *The Education of American Businessmen* (New York, 1959). See also, G. L. Bach, "Some Observations on the Business School of Tomorrow," *Management Science*, 4 (1958), pp. 351–364; and H. J. Leavitt and T. L. Whisler, "Information Technology and Management in the 1980's," *Harvard Business Review*, 36 (Nov.–Dec. 1958) pp. 41–48.

[3] A current example is C. W. Ramfalk, *Top Management Selection* (Stockholm, 1957). This is a careful, and an interesting study of executive progress in Swedish industry. We feel, however, that Ramfalk focuses on statistical tests to an extreme degree. Through this focus, he does not communicate much of the information that one needs to build from his experience to plan better programs of research on the questions that he attempted to study.

[4] N. Martin and A. Strauss, "Patterns of Mobility Within Industrial Organizations," *Journal of Business*, 29 (1956), pp. 101–110.

[5] M. Dalton, *Men Who Manage* (New York, 1959), Ch. 6; C. H. Coates and R. J. Pellegrin, "Executives and Supervisors: Informal Factors in Differential Bureaucratic Promotion," *Administrative Science Quarterly*, 2 (1957), pp. 201–215.

[6] D. Riesman, *et al.*, *The Lonely Crowd* (New Haven, 1950); W. H. Whyte, Jr., *The Organization Man* (New York, 1956); C. Argyris, *Personality and Organization* (New York, 1957); C. Argyris, "The Individual and Organization: An Empirical Test," *Administrative Science Quarterly*, 4 (1959), pp. 145–167.

More than we, as authors, would like, this article is in the speculative, exploratory tradition of the other articles and books cited; but in addition to presenting some findings about career progress among a sample of men that we have interviewed, we have made a modest effort to suggest ways of focusing future research efforts.

We began with two questions. Why do some men move ahead more rapidly in management during their first five or ten years in industry than others with essentially the same education and experience? To what extent do the men who move ahead rapidly act as agents of their own progress?

To answer these questions, we have drawn on interviews with 30 graduates of a two-year M.S. program in industrial administration that was established "to train men for ultimate advancement to general management positions." Almost all of the men did their undergraduate work in engineering or science. The men are distinguished as a group by a high level of intellectual ability—significantly higher than the average for senior executives in an advanced management program at the same graduate school and higher than the average for most other graduate business schools. Most have middle-class family backgrounds. None of the men interviewed had been in industry more than eight years since graduate school.

The men are not a representative sample of college graduates in industry; but because of their ability and their combined training in engineering and management, they have been eagerly recruited by industry for a variety of jobs. Unusually high median starting salaries for the classes from which our sample was drawn reflect personal qualities of the men, the reputation of the school, and a growing interest of companies in hiring men with training in management.[7]

[7] *Business Week* (October 3, 1959), p. 63, noted that in medium-sized firms there had been an increase of 64 percent over recent years in the number of men in management, but an increase of 118 percent during the same period in the number of men in management who held business school degrees.

Our interviews ranged in length from two to seven hours and were recorded. Most were divided into segments, each one conducted by a different interviewer. The general pattern of interview questions was planned in advance, but the specific questions put to each individual varied. Usually about half the interview was devoted to finding out what a man was doing on his job, how his work had changed since starting in industry, and in great detail, how he had handled specific, major tasks. The remainder of the interview was used for questions about his career objectives, about the environment in which he worked, about his major sources of satisfaction and dissatisfaction, about his assessment of his own performance and potential, and about his outside activities and family life.

For a third of the men, we were able to get supplementary information in conversations with their superiors. These interviews were generally much briefer. In addition to evaluations of the men's performance and potential, interviews yielded valuable secondary perspective on the opportunities and constraints which the men faced.[8]

A study of the experiences of the thirty men whom we interviewed does not enable us to test, with precision, hypotheses about factors in career progress. It yields some interesting preliminary findings, however; and it suggests what we feel to be important strategies for further research.

Career progress, as our interviewees described it to us, depends greatly on the strategies or heuristics that an individual employs in "his game" with the organizational environment that he encounters at work. Un-

[8] Our efforts represent a continuation of a program of testing, in-school evaluation, and post-graduate follow-up that H. G. Miller and H. Guetzkow initiated in 1952. Other elements of the research have included (1) an annual administration of test and questionnaire batteries to incoming students, (2) the collection of grades and faculty and peer ratings on men while they are in school, (3) a limited program of interviews with graduates in 1954 and 1957, and (4) a questionnaire survey in 1958 of graduates of the school, of men who were admitted but who did not enroll, and of a sample of men who could have qualified for admission but who elected not to do graduate work.

derstanding how a man "gets ahead," in this view, depends only indirectly on knowledge of his family background or of his personal traits. Primarily, it requires knowledge of the specific environment in which he works and of the heuristics he brings to bear in dealing with the constraints and opportunities that it provides. We hypothesized that relatively successful and unsuccessful interviewees would differ in their rules of thumb for diagnosing, evaluating, and responding to the environment.

This way of approaching career progress seems promising to us for several reasons. First, because the individual's interaction with his environment is stressed, we are forced to examine the process of advancement in industry—not just its correlates. Second, although there are problems in inferring a man's heuristics for operating in an organizational environment, it is reasonable to expect these heuristics to be more directly related to his performance than the biographical and personality variables that influenced the development of the heuristics. Third, the focus on heuristics which men use in problem solving and decision making has been shown in other studies to be an extremely fruitful one, leading both to different kinds of theories of problem solving and to new methods for being more precise and rigorous in the analysis and prediction of individual behavior. The work of Bruner and the work of Newell, Shaw, and Simon, in particular, show what can be done with relatively simple inferences about problem-solving strategies and their effects on outcomes.[9]

A first characteristic of the environment in large organizations is its indifference to the advancement of most individuals. Large companies today may offer assurance of tenure to young men, as Whyte and others have argued,[10] but they give no guarantee of promotion to top management positions. Relatively few of the men who enter from colleges and universities can become candidates for top jobs. Hence it is not surprising that among our interviewees, the men who have moved ahead rapidly are men whose goals are to advance. Their behavior is governed by the desire to do managerial work or to achieve managerial income and status. They want to attain positions where they can act independently and be judged by results. As one said:

> "I want to be in a position where if I get fired, I get fired for something *I do*—not something that somebody else does."

They are eager to try new jobs. They indicate that no job which they find themselves able to handle will satisfy them for more than a few years; and although they change organizations less frequently on the average than their less successful classmates, they actively scan the environment for alternative opportunities.

Among the men who progressed slowly, there was evidence of more limited aspirations. In contrast to their more successful counterparts, they professed:

1. Less desire for the specific benefits (such as power, autonomy, income, status) that a managerial position is perceived to confer.
2. Less tolerance toward the perceived costs of being a manager (such as personal isolation from subordinates, demands on time and health, insecurity of job tenure).
3. More commitment to and identification with their present jobs and present working conditions, a factor which Coates and Pellegrin have stressed in their studies of executives and supervisors.[11]

[9] J. S. Bruner *et al.*, *A Study of Thinking* (New York, 1956); A. Newell and H. A. Simon, "The Simulation of Human Thought" (RAND Corporation paper P-1734, 1959); See also W. R. Reitman, "Heuristic Programs, Computer Simulation, and Higher Mental Processes," *Behavioral Science*, 3 (1959). A pioneering effort at comparing a simulation model with other kinds of formal models is a doctoral thesis by J. Feldman, "An Analysis of Predictive Behavior in a Two-Choice Situation" (Carnegie Institute of Technology, 1959).

[10] Whyte, Jr. (See note 6); A. Harrington, *Life in the Crystal Palace* (New York, 1959).

[11] C. Coates and R. Pellegrin, "Executives and Supervisors: A Situational Theory of Differential Occupational Mobility," *Social Forces*, 35 (1956), pp. 121–126.

Questions of causal inference can be raised appropriately here. We cannot rule out the possibility that even after a few years in industry, the observed differences in men's goals were the result of their differential experiences of success and failure. The feedback of performance on levels of aspiration has been documented in other studies.[12]

To a large extent, though, the same differences in levels of aspiration that men reported after several years' experience could be seen when the men were still in graduate school. Thus, they can legitimately be considered as determinants as well as outcomes of progress in management.

In what ways might the display of active interest in advancement influence a man's progress? First, it may affect the jobs that he tackles, the standards that he sets for his performance, and the contacts that he tries to make. Second, in some situations it may actively help him bargain for a promotion. Third, we find evidence that a man's interest in advancement and his estimate of his own potentialities often affect the judgments of superiors who lack other data on which to make independent assessments. This is particularly true where a manager must assess the potentiality of a subordinate whose work involves such "esoteric" techniques as computer simulation or linear programming. Under these conditions, as Festinger's theory of social comparison processes[13] might suggest, the man himself sometimes becomes the most trusted source of information about his own abilities and work.[14]

Interest in becoming a manager, though, is rarely a sufficient basis for "getting ahead." In working through the maze of constraints and opportunities that surround them, the men who want to advance rapidly must pay particular attention to the expectations and standards of the men who govern their chances for promotion.

This is not a simple matter of willingness to conform, as some recent popular writings have suggested. Even a man who wants to conform must first decide what to conform to. First of all, his environment changes continuously. Large organizations are not monolithic. Sub-units within them pursue different goals and impose different standards on employees. Each time a man takes on a new assignment or begins to work with new people, he becomes subject to different kinds of constraints. The instability and ambiguity of the environment is accentuated especially for the younger men who are moved around frequently for purposes of "orientation and training."

Second, the young men we interviewed got relatively little feedback from superiors about their performance and their chances for advancement. The flow of this kind of information is impeded by the demands of other tasks, by the reluctance of some supervisors to criticize or praise, and by the overly formalized, almost ritualistic evaluation schemes to which some organizations hold.

Third, the feedback is often deceptive. Our findings agree with Dalton[15] and others who have shown that there are sizable discrepancies between "public" standards for evaluating performance and the standards actually used. A man's search for information may also be hindered by wishful thinking, by conspicuous but irrelevant events in the organization, or simply by the loss of information in transmission from one man to another. In some cases, the individual even

[12] R. Pellegrin and C. Coates, "Executives and Supervisors: Contrasting Definitions of Career Success," *Administrative Science Quarterly*, 1 (1957), pp. 506–517; E. Chinoy, *Automobile Workers and the American Dream* (New York, 1955).

[13] "A Theory of Social Comparison Processes," in P. Hare *et al.*, *Small Groups* (New York, 1955), pp. 163–187.

[14] One graduate who was seeking an advanced position in electronic data processing and who had considerable time in which to carry out his search tried an experiment. Without advanced knowledge of what prospective employers might offer, he varied the "acceptable salary range" that he quoted to different employers. He received several offers; and on an annual basis, the amount of the offer in each case was about $500 below the minimum salary figure he had quoted to the company even though the highest and the lowest minima quoted to different companies were nearly $2,000 apart.

[15] Dalton (See note 5).

may have to deal with deliberately misleading "suggestions" offered by his rivals for promotion.

Finally, conformity is not a simple matter. Because the environment is largely beyond a man's control, he cannot hope to choose a course of action which is sure to improve his chances for advancement. We find instead, as Simon and his colleagues have found in a number of other problem-solving contexts,[16] that individuals search for heuristics—rules of thumb which are likely to promote but which in no sense guarantee their success. A man's aspirations tend to be local, directed toward finding a satisfactory resolution of problems faced in his immediate job situation. The long-run implications of action often cannot be known in advance.

Even for men who have had relatively successful careers, a combination of inconsistencies and ambiguities in the environment will occasionally provoke a crisis. Consider an interviewee who had recently moved from a job in a market analysis group to the position of assistant to a factory manager. In his first few months of work, he greatly impressed the manager by his ability and ambition. The manager took a personal interest in his development, for the manager himself had advanced very rapidly as a young man. The manager soon assigned his assistant to work for the factory scheduling chief and gave the assistant the distinct impression that he would soon be put in charge of all production scheduling. The manager expressed considerable dissatisfaction with the way in which scheduling was being handled by the current chief, an older man who had fought his way up through night school and a long line of manual and clerical jobs to win a post in management.

The young assistant met a cold reception in the scheduling department. The scheduling chief had wanted an assistant with experience who could lighten his work load, not a new man to train. He resented the speed with which "youngsters with a college diploma" were moving into positions that were equal to his own.

The assistant had no clear evidence that his new boss felt this way, and he wanted to continue his upward progress. On the basis of the information that he had, he adopted as his operating heuristic strategies of behavior that presumed the continuing confidence and support of the factory manager and that rested heavily on the manager's expressions of disapproval with the scheduling chief's work. One night, after a week of particularly trying relations with his new boss, the assistant complained to the factory manager about the scheduling chief's refusal to delegate tasks or to consider new methods.

The factory manager listened and said very little; but within a short time, the assistant was transferred to a less important job under a very demanding supervisor and he was cut off from all but a few formal contacts with the factory manager. The assistant recognized that he had been demoted, and through a staff man in the plant, he gained a distinct impression that he stood in a much poorer relation with the factory manager. The manager never told his former assistant directly why he had beeen demoted; neither did the factory personnel man. Only after a period of several months did the manager tell his views to a man from outside the plant and give permission for the outsider to relay what he said to the ex-assistant. The young man's "mistake" while working under the scheduling chief had been to overlook the central proposition around which *The Caine Mutiny* was written: a man's first job is to satisfy his immediate superior. In this situation, it was more important to the factory manager that his assistant please the scheduling chief than that he initiate needed reforms in scheduling procedures.

This was a straightforward preference that

[16] A. Newell, J. C. Shaw, H. A. Simon, "The Elements of a Theory of Human Problem Solving," *Psychological Review*, 65 (1958, pp. 151–166), H. A. Simon, "Theories of Decision-Making in Economics and Behavioral Science," *American Economic Review*, 49 (1959), pp. 253–283.

the assistant might have recognized and could have followed if he had not come from another setting in which young men were encouraged to present new ideas and new methods, if he had been told that this was local policy, and if he had not been misled by his initial support from the factory manager.

The assistant we have described was not very sensitive to many of the facets of his new environmental situation.

The men who have made rapid progress seem, in their strategies, to be especially sensitive to specific features of the environment in which they are currently working. One man declares:

> "I try never to ask my boss for anything that I think he will . . . feel that he has to say 'no' for. This is very hard for him to do."

Another comments with specific reference to his own recent experiences:

> "If it gets to be known that you complete the job, it is worth a lot. . . . I think most of the failures in business are of incomplete jobs rather than incompetent jobs."

Such statements suggest that in analyzing the environment, a critical aspect of sensitivity is a man's ability to see himself, his surroundings, and his job the way that his superiors do—even though he need not always act as they would.

In their descriptions of how they have handled tasks, the more successful men tend to be more explicit in stating the goals they were working toward and in explaining the relation of these goals to the immediate environment. They emphasize in their descriptions of action and strategy not only what they do, but how their actions mesh with and depend on the actions of others around them. Describing attacks on problems, they are more explicit about the specific alternatives that were open and about the concrete conditions which affected their choices among them.

The less successful men, on the other hand, seem not to order their heuristics for action so directly in terms of the immediate problem situation. In some cases, they seem less aware of what is expected of them; in other cases, they prefer to follow strategies which are familiar or which they personally prefer in place of the strategies which the situation might seem to call for.

As an example, two of our interviewees held short-term jobs as trouble shooters in small plants in poor financial condition. Their roles in the plants were ambiguous. Each was responsible to over-all company management for improving conditions, but each had to work through managers and supervisors who had been in the plant for a long time.

The first made a detailed analysis of the conditions necessary for organizational survival and kept this goal ahead of all others. He was sensitive to his personal relations with men in the plant and wanted them to be good, but he was willing to be known as "the man from the skunk works" in order to satisfy the situationally defined goal—keeping the plant going. The second man met similar problems and opposition; but defining his role chiefly on personal grounds, he directed his efforts mostly toward eliminating points of friction between himself and other employees. He does not claim to have accomplished much for the firm, but he refers with satisfaction to his success at making friends with plant personnel and customers. The role that the first man established for himself was essentially managerial, in keeping with the requirements of the higher management upon whom his career prospects then depended. The role that the second man adopted was not suited to accomplishing the job his superiors set him; it was conciliatory at the expense of being constructive. The first man made his plant profitable; the other did not.

A related difference between these two men which seems also to apply more generally in our sample is the attitude they showed toward the organizations they

worked in. The first man, in reflecting on his experiences, reveals in his operating heuristics a high degree of detachment from the organization. The independence that he and some of the others who have moved ahead rapidly show seems based on confidence that they can handle their job, in belief that they can bounce back from unsuccessful performances, and in a firm distrust of the organization as a protector of their own long-run interests. Some of these men describe their relations with the organization as a game, with the organization characterized as not much more favorable an opponent than "nature." They believe that some of the short-run, local "opportunities" which turn up may harm their long-range career prospects. They maintain a wide range of independent contacts to evaluate their present position and to develop alternative opportunities. They are not likely, as are some of the less successful men, to rely solely on their immediate superiors to define tasks, to map their courses of action, or to find and screen alternative jobs.

We find that men also tend to profit by being aggressive and by taking the initiative in defining and elaborating their roles in the organization, provided they are careful to observe local norms about what young college graduates may and may not do. Seizing the initiative identifies a man as willing to accept responsibility, take risks, and as someone who will work without time-consuming supervision. Furthermore, it lets him emphasize in his performance the things he is most able to do or the things that have good chances of outcomes favorable to the organizational unit which he finds that have not been recognized or worked through by others in the organization.

In summary, we have argued that the men who do well at the start of their careers in large organizations *want* to do well in the jobs that such organizations provide. Their interests and the goals that they set themselves are consistent with the problems they must solve to get ahead. They have better developed analytic heuristics and thus are more sensitive to salient features of their immediate job environments. They are quick to adapt their strategy to the immediate local conditions they perceive. At the same time, their over-all problem orientation shows an attitude of detachment toward and independence from the organizations in which they work. They do not passively leave the definition of their job and the determination of their future to the discretion of their superiors. They regard themselves as active agents of their own progress. They are resilient to setbacks. They are more willing to take reasonable risks, and they meet reprimands or rejections with relative equanimity.

The goals and strategies of young men have not received the attention they deserve as factors in obtaining advancement into management. Our effort has been to discern the kinds of heuristics that different men have developed and used and to relate these to the environments in which they work. By still more intensive interviews and observation, both with the men and with their superiors, we hope to move beyond exploratory analysis of the kind reported here to more formal predictions about how men with different sorts of heuristics will fare in varying environments.

What Every Businessman Should Know About the Antitrust Laws

VICTOR R. HANSEN

In this article you will find guideposts to follow in determining whether your company's business operations violate our nation's antitrust laws.

Economic policies and legal antitrust policies in one sense have a common goal. Both strive to achieve an economy which gives freedom of opportunity. Both strive to help the consumer.

Economists as such are concerned with numerous factors which contribute to our economic welfare. They seek to evaluate the trends of the economy. They study wage and price levels and design measures to check inflationary trends.

Legal antitrust policies are also concerned with the public welfare. But the objective is arrived at through different routes. It is not the function of those in charge of the enforcement of the antitrust laws to exercise economic regulation. They are not concerned basically with whether prices are high or low. They are, in essence, a law enforcement body, as distinguished from a fact-finding body. Their aim is to preserve competition and to create conditions which permit competition to flourish. To put it succintly, the antitrust laws cannot compel competition; they only make it possible.

In carrying out these functions, those who enforce the antitrust laws must act within the legislative frame of reference. That frame of reference includes, however, a great deal more than the mere language of the statutes that are administered. The boundaries of the antitrust laws are marked by judicial interpretation. The numerous decisions of the federal courts and the Supreme Court which interpret the antitrust laws provide the guideposts which must be followed in planning and executing an antitrust program. It is these guideposts that I hope to point out to businessmen in this article.

The principal antitrust statutes which the Antitrust Division of the Department of Justice enforces are the Sherman Act[1] and the Clayton Act.[2] Although there are numerous provisions contained in these two statutes, the major part of the Antitrust Division's work centers on three sections: Sections 1 and 2 of the Sherman Act and Section 7 of the Clayton Act.[3]

The Department of Justice shares responsibility with the Federal Trade Commission in enforcing Section 7, which deals with mergers. Other provisions of the Clayton Act are enforced primarily by the Commission. Charges under these provisions sometimes are combined with charges brought in Sherman Act cases.

In analyzing current antitrust policies, I shall discuss first the principal problem arising in cases brought under the Sherman Act. Second, I shall sketch some of the problems and novel situations arising in the increasingly important Section 7 merger cases.

[1] The Sherman Act, enacted on July 2, 1890, c. 647, 26 Stat. 209, was amended by the Miller-Tydings Act of August 17, 1937, c. 690, 50 Stat. 693, and by the Act of July 7, 1955, c. 281, 69 Stat. 282, increasing fines from $5,000 to $50,000.

[2] The Clayton Act was enacted on October 15, 1914, c. 323, 38 Stat. 730, and has been amended on a number of occasions.

[3] Section 3 of the Sherman Act is equally important but applies only to the District of Columbia, the Territories, and between them and the States or foreign countries.

General Purposes of the Sherman Act

Perhaps the best description of the general purposes of the Sherman Act is contained in a statement made by the Supreme Court in a recent opinion:[4]

> The Sherman Act was designed to be a comprehensive charter of economic liberty aimed at preserving free and unfettered competition as the rule of trade. It rests on the premise that the unrestrained interaction of competitive forces will yield the best allocation of our economic resources, the lowest prices, the highest quality, and the greatest material progress, while at the same time providing an environment conducive to the preservation of our democratic political and social institutions. But even were that premise open to question, the policy unequivocally laid down by the Act is competition.

Courts are frequently called upon in Sherman Act cases to measure the actual or probable effect of particular business conduct upon competition. Unreasonable restraints upon competition fall within the ban of Section 1 of the Sherman Act. Extensive economic information and data may be introduced at trial in order to establish that a particular restraint upon competition is unreasonable.

Economic testimony concerning the effect of challenged business practices upon competition is not necessary or even appropriate in many of the familiar types of cases brought under Section 1 of the Sherman Act. Let me illustrate. If a group of companies is charged with fixing prices for the sale of a product which the group manufactures, the issue is simple. Either the companies agreed to fix prices or they did not. If the Government proves that they did agree, its proof is complete. Such an agreement is presumed as a matter of law to have a deleterious effect upon competition and no further inquiry into the disastrous effects upon competition is made.

Criticism has sometimes been leveled at the Antitrust Division for too much emphasis upon price-fixing cases. More recently, by contrast, some thought has been voiced that the Department should have brought a price-fixing case for the recent Steel-industry price rise. Let me hasten to point out that while the issue in a price-fixing case is a comparatively basic one, its proof is not always simple. Proof there may be, as there was in the Steel situation, that prices rise in quick succession. Proof there may also be that prices are administered in that they respond not to supply and demand but to the prices adopted by the price leaders of the industry. Yet all of this may fall short as proof of a price-fixing violation. The law still requires evidence that the parties conspired, namely, that they agreed to adopt the price increases.

Where an industry consists of only a few sellers, administered pricing becomes not only possible, but generally results. As the President of the American Economic Association said in his book on *Monopoly and Free Enterprise,* "the fewer the sellers the easier it is for them to reap the fruits of conspiracy."[5] And as one noted antitrust lawyer aptly phrased it: "The price announcement of one of the companies in the field, typically the dominant concern, or principal producer, is *loyally* followed by most of its competitors."[6]

But the greater challenge from an economic standpoint may be found in the so-called monopoly cases brought under Section 2 of the Sherman Act. At the heart of these cases are generally found problems dealing with the nature of the industry, the number of firms competing therein, their comparative size, and the ease of entry into the business. All of these factors—to use an economic

[4] *Northern Pacific R. Co. v. United States,* 356, U.S. 1, 4.

[5] Stocking and Watkings, *Monopoly and Free Enterprise,* Twentieth Century Fund (1951), pp. 110–111.

[6] Milton Handler, *A Study of the Construction and Enforcement of the Federal Antitrust Laws,* TNEC Monograph No. 38 (1941) pp. 40–41.

term—deal with market structure. This, however, is not the whole of the picture.

Market structure, in itself, is not the only subject of inquiry in monopolization cases. Market behavior or market conduct still plays a part—although a less important part—in cases brought under Section 2 of the Sherman Act. This is understandable. The Sherman Act does not prohibit monopoly in a passive sense. It prohibits what it terms "monopolization," or active monopoly.

To meet this requirement of monopolization as distinguished from monopoly, the courts have evolved the principle that there must be a showing of both monopoly power and an intangible something called "intent." This element known as "intent" may not mean the same thing to an antitrust lawyer that it does to an economist. Actually, it does not mean the same thing today that it meant ten or fifteen years ago. It may mean something else tomorrow from what it means today. The Sherman Act has the breadth of a constitutional provision, as indeed it should have if it is to keep pace with the demands of a changing economy.

To make a showing of intent in monopolization cases, antitrust lawyers throughout the years have generally produced whatever evidence could be found illustrating the use of so-called predatory practices. This has been done more out of an abundance of caution than out of reluctance to push ahead for new frontiers in the law. In more recent cases,[7] the courts have held that the business conduct from which intent will be inferred need not to be so drastic as to be considered predatory. Nor, in fact, need it even amount to a restraint of trade. It is sufficient that the conduct employed by a monopolist, either singly or in combination with others, be exclusionary.

Thus, to quote Judge Wyzanski's holding in the *United Shoe* case, given a showing of monopoly power, it is sufficient to establish a violation of Section 2 "for one having effective control of the market to use, or plan to use, any exclusionary practice, even though it is not a technical restraint of trade."[8]

What then is this quality of intent and what is the evidence from which its existence shall be inferred? In the *United Shoe* case, the court described the exclusionary practices as "contracts, arrangements, and policies which, instead of encouraging competition based on pure merit, further the dominance of a particular firm." "In this sense," the court said, "they are unnatural barriers; they unnecessarily exclude actual and potential competition; they restrict a free market."[9]

This type of evidence is certainly a great deal less than evidence of predatory business behavior as that term was generally understood in antitrust parlance. Yet it may still be something other than mere evidence of market control. One antitrust lawyer writes today:[10]

> Our faith in the antitrust laws will probably continue to be somewhat blind since it is unlikely that economics will ever develop tools to measure accurately the truth or falsity of the basic premises on which our allegiance to the laws of competition rest. But this is no reason why we should permit new verbalisms such as "oligopolistic competition" to disguise the fact that the ultimate thrust of the Sherman and Clayton Acts is at the mere possession of power to exclude or lessen competition.

In discussing the necessity of showing the possession of power over price or competition in the case now popularly known as the *Cellophane* case,[11] the Supreme Court said:

> It is inconceivable that power could be controlled without power over competi-

[7] *United States v. United Shoe Machinery Corporation* 110 F. Supp. 295, affirmed 347 U.S. 521; *United States v. Aluminum Co. of America*, 148 F. 2d 416 (C. A. 2).

[8] 110 F. Supp. 295, 342.

[9] (See note 7) pp. 344–345.

[10] William L. McGovern, "The Power and the Glory: The du Pont GM Decision," the *Georgetown Law Journal*, Vol. 46, No. 4 (1958), pp. 655, 670.

[11] *United States v. E. I. du Pont de Nemours and Company*, 351 U.S. 337, 392.

> tion or vice versa. This approach to the determination of monopoly power is strengthened by this Court's conclusion in prior cases that when an alleged monopolist has power over price and competition, an intention to monopolize in a proper case may be assumed.

Whatever the ultimate outgrowth of the trend may be, judicial interpretation of the law has certainly come a long way from the now thoroughly discredited doctrine that monopoly power or market control is only bad when accomplished by predatory business conduct.

Aside from the questions of market structure and market behavior, we sometimes meet with the suggestion—grounded in economics—that if the market performance of an industry is good, we should do nothing to upset the good performance applecart. When I speak of good market performance, I speak of an industry which is regarded as efficient, which has progressed in a technological sense, and which provides the consumer with a choice of good products at reasonable prices. Some economists express the view that if the industry is relatively stable and ease of entry is not too difficult, this in itself is the ultimate good to be desired. Here again the underlying reason for analysis may color the approach to the problem.

An economist, for example, making a study of a particular industry to recommend investments may find that the market performance of an industry is excellent. If there are only a few firms in the business, if these firms have a history of collaborating on prices, dividing territories, or allocating customers, the industry may be an excellent candidate for an investment program.

But an examination of market performance by an investment analyst is not the ultimate end from a legal antitrust standpoint. The industry may be efficient. It may engage in research which gives birth to many new products. Antitrust policies do not conflict with such good market performance. But antitrust policies strive to promote competition as such and not only desirable economic performance. Additionally, the antitrust laws assume that products or the service might be better and the prices lower if no illegal restraints and none of the attributes of monopoly were present. And it is not a foregone conclusion that comparable research and comparable economies of production and distribution would not result if there were a larger number of sellers. For these very reasons, good market performance is in itself no defense to a charge of violation of the Sherman Act.

The basic question in all monopolization cases from the legal as well as from the economic standpoint is whether monopoly power exists. What, you may ask, are the elements of monopoly power as defined in a legal sense? On this point the law is certain. Monopoly power may be found either in power to exclude competition or power to fix or control prices.

In order to determine whether power to exclude does exist, market structure may come in for considerable economic analysis. A large percentage command of an industry may in itself be an earmark of power to exclude. Other factors, such as comparative size measured against a number of smaller competitors, may be equally compelling. Strategic advantages may be such as to give command over the entry of potential competitors. Thus, in the *Aluminum* case,[12] Judge Learned Hand adverted to the great organization which Alcoa possessed, having the advantage of experience, trade connections, and the elite of personnel. It was the misuse of these strategic advantages by the constant and progressive increasing of capacity each time that a newcomer threatened to enter the aluminum industry which caused the court to find Alcoa's course of conduct to be exclusionary.

Power to control prices is, the Supreme

[12] *United States v. Aluminum Co. of America*, 148 F. 2d 416, 429 (C. A. 2).

Court has said, equally important as an indicia of monopoly power. In a now famous case against all of the leading manufacturers of cigarettes,[13] this power to control prices was found in a combination of factors. Prominent among these was the ability to raise prices arbitrarily in times of depression and to lower prices to below cost and hold them there until the competition of cheaper cigarettes had been eliminated.

Extensive economic data, charts, and graphs are prepared and presented in monopolization cases to depict price trends, price changes and their effect upon sales, as well as profit margins of defendants and their competitors. This veritable sea of economic data must usually be analyzed and related in the first instance to a particular market. Definition of the market as such may be said to be the initial step that must be undertaken in a monopolization case. At the outset we must determine the product or products which are to be included as being within the relevant market. This subject has many facets and could be discussed *ad infinitum*. However, let me mention but briefly the principal case out of which this problem arises.

There has been much discussion and debate concerning the meaning of the *Cellophane* case and the language used therein by the Court.[14] The Supreme Court held that the production of cellophane had not monopolized because cellophane competed with other flexible wrapping materials. Thus, the subject of substitute materials, so dear to an economist's heart, was brought forceably to the fore. No more definitive rule can be declared, the Supreme Court said, than that commodities reasonably interchangeable by consumers for the same purpose must be considered when determining whether control of price and competition exists.

It suffices to say that the question of what substitute materials should be considered as being competitive with any given commodity in a monopolization case is not an easy matter. In due time, subsequent decisions may pave the way for a clearer understanding of the test which must be met and the type of evidence which must be produced.

It should be pointed out that this type of analysis may not be essential in all monopolization cases. The words of the Supreme Court in the *Cellophane* case ("Illegal monopolies under Section 2 may well exist over limited products in narrow fields where competition is eliminated"[15]) give promise of surmounting the market problem at least in situations where exclusionary market behavior has taken place.

The Clayton Act vs. Mergers

The question of mergers has became an ever more important subject in the antitrust field. Opinions may differ among economists on the advisability on this constant march toward concentration. But from the legal standpoint, legal philosophy is guided by the responsibility to enforce Section 7 of the Clayton Act.

The responsibility for the enforcing of Section 7 rests with the Department of Justice and the Federal Trade Commission. Both agencies cooperate to prevent duplication of merger actions and investigations. Both actively pursue those investigations which they initiate.

The Antitrust Division has no subpoena power by which to compel the production of material from which to ascertain the facts underlying a merger. The Commission, on the other hand, has subpoena power by which it may compel not only production of documentary material, but also the testimony of witnesses. Additionally, the Commission has statutory power to require corporations, other than banks and certain common carriers, to furnish reports or answers to specific

[13] *American Tobacco Co. v. United States*, 328 U.S. 781, 804–09.

[14] *United States v. E. I. du Pont de Nemours and Company*, 351 U.S. 377.

[15] (See note 14) at 395.

questions. You may well ask why the Department, then, does not utilize the functions of a grand jury to obtain evidence concerning proposed mergers. The answer is that Section 7 is not a criminal statute. That avenue is closed to them.

Section 7 of the Clayton Act was passed by Congress originally in 1914. More recently (in 1950), Congress became so concerned with the increasing number of mergers that it amended Section 7 to make the legal test less stringent and to clarify the types of situations which it embraced. Prior to 1950, Section 7 prohibited acquisition of the stock of one corporation by another where the effect of said acquisition may be to substantially lessen competition between the acquiring and the acquired company.[16]

Section 7, amended in 1950, deleted the reference to competition between the acquiring and the acquired firm. It now prohibits acquisition of stock or assets by any of the stock or assets of another corporation engaged in interstate commerce, namely, a corporation not necessarily a competitor where the acquisition has the prescribed effect. Section 7, as it now stands, thus prohibits mergers between one corporation and another where the effect may be substantially to lessen competition or tend to create a monopoly in (1) any line of commerce, or (2) any section of the country.

The Senate, in its Report on the 1950 bill, stated that for a merger to be subject to the Clayton Act, it is not essential that the line of commerce which may be lessened substantially be a large part of the business of any of the corporations involved in the acquistion.[17] The House Judiciary Committee, in its Report, hastened to comment that acquisitions of stock or assets have a cumulative effect. The bill was intended, the Committee said, to permit intervention in such a cumulative process.[18]

Since the 1950 amendment to Section 7, it is clear that the merger prohibition applies not only to those mergers which substantially lessen competition between the acquiring and the acquired company, but also to those mergers whose impact is felt by competitors of either the acquiring or the acquired company. To put it in the words of the House Judiciary Committee, the change was made "to make it clear that the bill applies to all types of mergers and acquisitions, vertical and conglomerate as well as horizontal, which have the specified effects of substantially lessening competition • • • or tending to create a monopoly."[19]

Horizontal mergers between competitors on the same level of industry are, of course, familiar to everyone. Vertical mergers which freeze competitors out of a source of supply or foreclose a customer's market are becoming increasingly common. Conglomerate mergers have not as yet been precisely defined. One source describes them as the "all other" category of mergers and acquisitions not included within horizontal or vertical.[20] An example, perhaps, of a conglomerate merger may be found in the Gillette Company, until recently primarily a manufacturer of razors and razor blades. This company, I am told, has acquired such varied interests as the Toni home-permanent business, the Papermate pen business, and some proprietary drugs.

A landmark decision interpreting the new Section 7 was handed down on November 20, 1958 by Judge Weinfeld in the Bethlehem-Youngstown case.[21] Judge Weinfeld, in an outstanding opinion, ruled that the merger would substantially lessen competition and tend to create a monopoly in many lines of commerce in many sections of the country. He relied upon, among other things, the substantial increase in the level of eco-

[16] 38 Stat. 731.
[17] S. Rep. No. 1775, 81st Cong., 2d Sess., 1950, p. 5.
[18] H. Rep. No. 1191, 81st Cong., 1st Sess., 1949, p. 8.
[19] H. Rep. No. 1191, 81st Cong., 1st Sess., 1949, p. 11.
[20] John M. Blair, "The Conglomerate Merger in Economics and Law," *The Georgetown Law Journal*, Vol. 46, No. 4, p. 672.
[21] *United States v. Bethlehem Steel Corporation and the Youngstown Sheet and Tube Company* (S.D.N.Y., Civil No. 115–328).

nomic concentration in the steel industry that would result in the merger. In rejecting the affirmative defense that the merger would enable companies to offer more competition to the United States Steel, the Court pointed out that other steel producers could, with equal force, argue that they should be permitted to merge in order to afford more challenging competition to United States Steel and Bethlehem, and thus the already highly concentrated steel industry would head in the direction of a "triopoly." Judge Weinfeld's opinion was the first to be rendered after a trial in a suit by the Government under Clayton Act, Section 7, as amended in 1950. This decision is, of course, a District Court decision, for the reason that the defendants decided not to appeal.

In another significant merger case, the *Brown Shoe* case,[22] the defendants' argument is that the line of shoes produced by Brown is not competitive with the line of shoes produced and sold by the Kinney Company; that the two lines sell in a different price range and are therefore complementary rather than competitive. The Government's view is that there is a substantial area in which competition may be lessened by the merger. In any event, in my opinion, the line-of-commerce test in Section 7 is far less rigid than that required by Section 2 of the Sherman Act under the Cellophane doctrine. The *Brown Shoe* case was decided November 20, 1959, and notice of appeal has been filed. The trial court generally followed the argument of the Government.

In the *du Pont-General Motors* decision, the Supreme Court held that du Pont and General Motors had violated Section 7 through the stock acquisition by du Pont of 23 per cent of the stock of General Motors.[23] It is interesting to observe that while the case had been brought under both the Sherman Act and Section 7, as it read prior to the 1950 amendment, the Supreme Court made no mention of the *Cellophane* case in rendering its decision.

While in *Cellophane*, under the Sherman Act, the Court found that the relevant market was the market for flexible wrapping materials rather than cellophane. In *du Pont-General Motors*, it rejected the argument that the relevant market was the market of all sales of finishes and fabrics to industrial users. On the contrary, it held[24] that:

> "The record shows that automobile finishes and fabrics have sufficient peculiar characteristics and uses to constitute them products sufficiently distinct from all other finishes and fabrics to make them a line of commerce within the meaning of the Clayton Act."

It should not be inferred that in view of the *du Pont-General Motors* case, all of the problems under Section 7 have been solved. Quite to the contrary. New decisions seeking to interpret or follow this decision are bound to emerge. During recent months a decision was rendered under Section 7 by the Court of Appeals of the 2nd Circuit in a case to which the government was not a party.[25] Because of the bearing which it may have on the merger situations, let me mention briefly what occurred. A refiner of cane sugar acquired stock in Crystal, a refiner of beet sugar, and demanded representation on Crystal's board of directors. The combination of the two companies would rank fourth in the sugar industry. Crystal sued for an injunction and divestiture. Upon appeal from the court's action in granting the requested injunction, the Court of Appeals said that the relevant market was the market for both cane and beet sugar.

The decision holds that the substantial lessening of competition in any line of commerce requires for determination (1) a definition of a relevant market, and (2) analysis of

[22] *United States v. Brown Shoe Company, Inc., and G. R. Kinney Co., Inc.* (E.D. No., Civil No. 10527), 179 Fed. Sup. 721.

[23] *United States v. E. I. du Pont de Nemours & Company*, 353 U.S. 586.

[24] (See note 23), 586, 693–94.

[25] *American Crystal Sugar Company v. The Cuban-American Sugar Company* (C. A. 2, 1958).

the nature and extent of the competition within that market. This has a familiar ring. It may speak more in tones of the *Cellophane* case than that of *du Pont-General Motors*. The decision speaks also of "quantitative substantiality" and "qualitative substantiality," but without giving any clear enunciation of the context in which the terms were being used.

In *International Boxing Club v. United States*,[26] the Supreme Court reaffirmed the *Cellophane* doctrine of reasonable interchangeability in a Sherman Act monopoly case. In *International Boxing*, the defendants were charged with having conspired to restrain and monopolize trade in championship boxing contests, and that they had monopolized these contests in violation of Sections 1 and 2 of the Sherman Act. It was the contention of the defendants that under the *Cellophane* principles, the relevant market included non-championship matches as well. Although the trial judge agreed that the *Cellophane* doctrine applied, he nevertheless found as a matter of fact, that non-championship bouts were not reasonably interchangeable with the championship contests. His conclusion was reached in relying upon the fact that these two types of contests differed substantially in the source of total revenue, particularly because of the sale of television and motion-picture rights, and in the prices charged for tickets.

[26] *International Boxing Club, v. United States*, 358 U.S. 242 (1959).

On appeal, the defendants contended that *Cellophane* had been misapplied. They argued that the physical identity of championship and non-championship contests necessarily put them in the same market in that both have one ring, two boxers, one referee, and are fought under the same rules. The Supreme Court had squarely before it whether to adhere to the *Cellophane* rule in monopolization cases as well as to whether it should be applied in attempt-to-monopolize and conspiracy cases. It held that the principle should govern both monopolization and conspiracy cases.

The *Cellophane* ruling applies both in Sherman Act proceedings and in Section 7 matters.[27]

Whether these decisions will prove to be a boon or a hindrance in the merger program is too early to say. That may depend partly on the scrutiny, analysis, and dissection which will surely be made of these opinions by economists, by scholars, and by those in the antitrust field who must seek to apply them. But, finally, it will depend on the judicial gloss which may be ultimately placed thereon by the Courts.

[27] *International Boxing Club v. United States*, 358 U.S. 242 (1959); *American Sugar Crystal Co. v. American Sugar Co.*, 259 Fed. 2d 524; see also Erie Sand and Gravel Co., F.T.C. Dkt. 6670 where it was found that lake sand dredged from Lake Erie was distinguishable from other sands and was not interchangeable; See also Reynolds Metal Co., F.T.C., Dkt. 7009, where decorative aluminum foil used by florists for decorative purposes is distinguishable from other decorative materials and from aluminum foil generally.

The Outlook for Canadian Growth in the Early 1960's

RICHARD H. HOLTON and DAVID C. SMITH

Should U. S. businessmen look to our glamorous neighbor of the north for investment opportunities in the 1960's—or has Canada had her heyday? Here is a forecast of Canadian economic development in the next few years.

Between 1947 and 1959, the Canadian Gross National Product rose almost exactly half again as fast as did that of the United States. During this period, Americans became far more conscious of their glamorous neighbor to the north; they looked to her as an increasingly important source of raw materials, as a strategic defense partner, and as an exciting and remunerative place for direct investment.[1] The Canadians have not been altogether pleased with this new attention from the U. S. Though Canadian-American relations undoubtedly face some mildly uncomfortable times ahead, there is little doubt that the U. S. will continue its intense interest in the Canadian economy and the Canadian people.

The postwar boom in Canada, when viewed in historical perspective, shares many of the features which marked earlier periods of accelerated growth in Canada. The Canadian prosperity of recent years has had its foundation in a strong export market for certain basic Canadian commodities, primarily minerals. Earlier years saw the wheat boom of 1900–13 and then, later, as the U. S. metropolitan newspapers grew while U. S. pulpwood supplies were dwindling, the rapid increase in the export of newsprint and wood pulp. Even in the eighteenth and nineteenth centuries, the surges in Canadian growth could be traced to the development and exploitation of some new export staple.

It now appears that the external stimuli to the Canadian economy quite possibly may not be as strong through the early 1960's as has been the case in the years since World War II. What are the implications of this sluggishness in the export market? Has the economic structure of the Canadian economy changed sufficiently to insulate it from the world market conditions? Or is it inevitable that Canada will face two or three years of relatively slow growth?

The Pattern of Canadian Growth[2]

To answer these questions, it will be helpful to review the basic causes of Canadian growth in the past and to see how the demand for export staples has had its repercussions throughout the economy. The developments of the last few years will then be compared with the historical pattern as a prelude to assessing the outlook for the early 1960's. Then some conclusions can be drawn as to how the interesting external financing mechanism which has operated in the past may operate over the next few years.

The succession of export staples which have stimulated Canadian economic develop-

[1] The problem of U.S.-Canadian economic relations is treated in *Canada-United States Economic Relations*, by Irving Brecher and S. S. Reisman, Royal Commission on Canada's Economic Prospects (Ottawa, 1957).

[2] Much of the material in this section is drawn from *The Canadian Economy; Prospect and Retrospect*, by Richard E. Caves and Richard H. Holton (Cambridge, 1959), especially Chapters 2–6.

ment over the past 250 years is quite impressive. The Newfoundland fisheries provided the first cause for modest settlement. In the course of the search for new fishing grounds, the possibilities of the fur trade were first discovered. But the fur trade was antithetical to settlement for a number of reasons. The beaver's distinct preference for dense woods rather than cleared land as habitat understandably led the trading companies to the view that the fewer settlers the better. The Indians provided an ample labor supply for this work except for the indispensable *courriers de bois*, who served as the essential link with the Indians. Furthermore, because the trading goods from Europe were far bulkier than the furs which comprised the eastbound cargo, shipping space westbound from Europe was at a premium.[3] Settlers, therefore, had to pay higher rates than if the excess capacity were on the westbound portion of the trip.

The Napoleonic wars brought the next major export staple boom when Britain turned to Canada for much of her naval timber requirements after her usual sources on the Baltic were endangered. Lumbering, quite unlike the fur trade, generated settlement and cleared land almost automatically. Furthermore, the eastbound cargo was far bulkier than the westbound freight (mostly settlers' supplies), so immigrants were brought to Canada at bargain rates.

By the middle of the nineteenth century, Britain had removed the preferential tariffs on Canadian lumber, but by this time the U. S. was growing at such a rate that Canadian lumber found a ready market south of the border. Meanwhile, in the backwash of the lumber camps, agriculture had developed and now was providing Europe with significant quantities of foodstuffs, particularly wheat and bacon and cheese from central Canada.

[3] Harold A. Innis, "Unused Capacity as a Factor in Canadian Economic History," *Canadian Journal of Economics and Political Science*, Vol., II (February, 1936), pp. 1–15. Reprinted in Innis, *Essays in Canadian Economic History* (Toronto, 1956), pp. 141–155.

The three major expansionary periods of the twentieth century, however, are the ones most noteworthy for purposes of this paper because they occurred after so many of the institutional factors at work today had developed. They reveal that, while the growth process has been based on a complex interaction of changes in components of aggregate demand and in supplies of factors of production, there has been a very close dependence on foreign economic conditions. The following crude model will provide an important basis for examining recent experience.

Let us suppose first of all that Canadian exports of a basic staple increase. The reason for this increase may be an upsurge in world demand for the commodity, or it may be, as in the case of wheat or minerals, that technological changes or rising costs in competing supply areas of the world improve Canada's competitive position. These factors may appear in combination or individually.

The export demand for the staple brings an upsurge in investment in plant and equipment needed in the export industry itself. Plant and equipment expenditures may rise not only in the export industry but also in other industries, such as shipping and raw material processing, which may be directly affected. This investment typically lags a bit behind the export demand simply because investment decisions cannot be made and implemented instantaneously. Changes in the level of investment expenditures together with changes in the level of exports have been the main causes of changes in the level of gross national expenditure in Canada. Gross national expenditure determines personal-income levels, and personal income in turn determines the level of consumption expenditures. There is some evidence that these consumption expenditures tend to lag behind personal income by a year, largely because consumption habits prevent immediate changes in consumption expenditures commensurate with income changes. This effect operates in both directions, i.e.,

when incomes fall, consumption expenditures seldom fall immediately into a long-run relationship with the new income level. Rather, these expenditures remain relatively high because people are slow to adjust their spending to the lower income level.

During the period when the exports of the staple are increasing rapidly, the level of imports responds both to the expansion in investment outlays and to the rise in personal-consumption expenditures. Canada's income elasticity of demand for imports is fairly high and is likely to be especially high during these periods of expansion. It is then that domestic manufacturers of both consumer goods and investment goods are operating at or near capacity, and some of the demand for both types of goods will spill over and become a demand for imports.

The total effect of a new export staple will depend in large part on the effect on immigration. In the case of the wheat boom of 1900–13, labor requirements of the new export staple were so immense that the population of Canada rose from 5.4 million to 7.2 million between 1901 and 1911, and by 1921, the census recorded 8.8 million persons. When immigration of this magnitude occurs, the demand for residential construction and for construction associated with many of the services creates a different type of demand for investment goods. Just how strong will be the demand for residential construction depends not only on the rate of immigration but also on the available stock of housing; so this particular repercussion from the export staple is only a possibility, not a certainty.

In this picture of the export upsurge and its repercussions, the role of foreign capital is particularly critical. The rise in imports of consumption goods, and particularly of investment goods, generates a deficit on current account. But the investment expansion is financed in large measure by foreign capital, so capital imports are substantial. The role of these capital imports is clearly twofold. They make it possible for the economy to expand its capital plant in response to the export demand more quickly and with less strain on domestic resources and prices than would be the case if the investment were to be financed with domestic savings alone. Furthermore, these capital imports prevent the adverse current account balance from putting the Canadian dollar under too great a pressure. In fact, it is quite accurate to say that the current account balance is adverse in part because of the capital inflow.

Growth Since World War II

The nature of the postwar expansion is reflected in Table I, which shows the 10 leading exports in 1939 and again in 1957, when exports as a whole were at a peak. Note that automobiles and automobile parts and fruits and vegetables had dropped off the list by 1957 and that petroleum and iron ore had been added. In 1939, the exports of the latter two items were negligible. There was no production of uranium ore and concentrates in 1939, yet by 1957, they fell only four million dollars short of qualifying for the leading ten export items. A more adequate picture of the change in leading export items over the 1939–57 period is reflected in the fact that during that time the proportion of total exports accounted for by minerals rose from 26.5 percent to 37.2 percent.

This increase in the role of mineral production in Canadian exports was accompanied by a shift of trade to the U. S., while the United Kingdom declined in relative importance as a market for Canadian goods. This drift saw the U. S. taking 59 percent of Canadian exports in 1957 as compared with only 41 percent in 1939. The United Kingdom, meanwhile, had reduced its share from 35 percent to 15 percent. Canada's trade has now clearly turned around from east-west to north-south.

The important role of the export staple in the postwar expansion is demonstrated by the decrease in the proportion of exports

TABLE I

TEN LEADING CANADIAN EXPORTS, BY VALUE, 1939 AND 1957
(millions of dollars)

1939		1957	
Newsprint paper	115	Newsprint paper	715
Wheat	109	Wheat	380
Nickel	58	Woodpulp	293
Copper and its products	53	Planks and boards	282
Planks and boards	48	Nickel	248
Aluminum and products	35	Aluminum and products	230
Woodpulp	31	Copper and its products	169
Fish and products	29	Iron ore	152
Automobiles and parts	25	Petroleum and products	155
Fruits and vegetables	20	Fish and products	131

Source: Dominion Bureau of Statistics, *Canadian Statistical Review, 1957 Supplement*, Table 50, and October, 1959, Table 50.

"fully manufactured" from 44 percent to 36 percent during the 1939–57 period. The proportion accounted for by raw materials rose from 30 to 32 percent and by partly manufactured goods from 27 to 32 percent. So the postwar expansion was like the others in that it was tied to export staples. It differed in that it was turned more toward the United States than toward the rest of the world, and the new exports were largely minerals, although forest products showed continued strength.

Although exports in the 1950's were equal to about 15 percent of the GNP, this ratio was lower than in the latter half of the 1920's, when exports amounted to roughly 20 percent of the GNP. Therefore, the reliance of the Canadian economy on the export market, though still very great, is declining slowly.

Did the pattern of investment expenditures follow the expected pattern during this period? Investment in the forestry, mining, and those manufacturing industries which are important exporters of processed primary materials[4] in 1937–39 accounted for 15 to 18 percent of total investment. In 1947, this proportion stood at over 20 percent, and in 1948, at 19 percent. During 1951–54, investment in other sectors rose at such a rate as to depress the export industries' share to 10 and 11 percent, presumably because of greater investment in defense industries and in manufacturing industries producing for the domestic market. Thus there is some evidence of a lagged response of this latter type of investment in the primary industries. By 1956, the export-oriented industries' proportion of total investment had moved up again, reaching nearly 15 percent before declining to only 9.2 percent in 1958. The proportion would have been considerably greater in 1954 and 1955 had it not been for the significant increases in investment in housing.

Personal income and personal consumption expenditures followed the increase in gross national expenditure rather closely, but they contributed in their own way to the expansionary process. The gross national expenditure increased by about 450 percent in current dollars, 1939–57, and as a result, personal income increased by nearly the same ratio, 435 percent. Because of higher tax rates in 1957, the ratio of disposable to total personal income fell somewhat, and personal-consumption expenditures rose only by about 410 percent. But the point worth noting at this juncture is that personal consumption expenditures on durable goods rose nearly twice as fast as personal consumption expenditures, or about 730 percent. Un-

[4] Wood products, paper products, non-ferrous metal products and non-metallic mineral products.

doubtedly this huge increase in consumer-durables output accounted for a substantial portion of the increase in capital expenditures in manufacturing during these years.

Personal consumption expenditures during most of the postwar years have been a source of considerable stability. When incomes have varied from one year to the next, the savings rate, rather than the rate of consumption, has absorbed most of the fluctuation. Thus, personal savings have provided quite a stabilizing, cushioning effect.[5]

Did the export boom attract immigrants, as had been true expecially in the days of the wheat boom and the opening of the prairies? In the five years 1936–40, gross immigration ranged from 11,000 to about 17,000 persons. But during the five years beginning with 1951, the range was from 109,000 to 194,-000, with the average being over 158,000. This enormous influx was the result in part of the efforts of the Canadian government, which maintained offices abroad to promote immigration actively. Such an immigration program would not have been pursued, of course, if there had been no jobs for the newcomers. But it is probably true, nonetheless, that immigration was greater than it would have been without the active solicitation by the Canadian government. In 1957, gross immigration was an enormous 282,000, in part because the Suez experience had jumped the United Kingdom immigration to Canada from 50,000 in 1956 to 109,000 in the following year.

This immigration was only one of the causes of the great expansion of the total Canadian population after the war. After having grown in population only from 10.4 to 11.5 million during the period 1931–41, the country added another 2.5 million by 1951 and still another 3 million since then. The 1958 population figure was 17 million.

Since the population now is almost 50 percent greater than just before the war, one is certainly permitted to ask where all these people are working. Did the new export staple industries absorb them directly?

Here again let us compare 1939, the prosperous prewar year, with 1957, the most recent year of prosperity for which our data are complete. The population over that period rose by a huge 47 percent. The work force, however, rose only 30 percent, largely because of the shift in the age distribution. Canada has not only been a "young" country in the past; in recent years she has grown a little younger. One can note in passing that the consequent increase in the number of persons supported by each member of the work force has significance for consumption expenditures.

Jobs for all these new workers were clearly not provided in the agricultural sector, which had provided so much employment during the 1900–13 period. Between 1939 and 1957, employment in agriculture actually fell precipitously, as in the U. S., from about 1.4 million to scarcely more than half that. So the Canadian economy had to provide jobs not only for the workers among the immigrants and for those resulting from the natural increase in population but also for the workers leaving agriculture. In forestry, where employment has been very erratic, the number of jobs available during some of the postwar years was more than twice the 1939 figure. By 1957, however, the number of forestry jobs stood at only about 60 percent above the prewar level. So the percentage increase in forestry employment was about twice as great as the increase in the total work force. But since this sector is so small (only about two percent of the work force is in forestry), we must look elsewhere for the bulk of the jobs provided the new workers.

We have said that the exports were strong in the postwar years primarily because of the world demand for Canada's minerals. Did the mines absorb the 30 percent increase in the work force? Interestingly enough, the answer is no. Employment in mining in-

[5] This cushioning effect is especially noticeable if the savings exclusive of farm inventory changes are plotted over time.

creased only 36 percent in 1939–57, just slightly more than total employment.

The new workers seem to have found employment primarily in manufacturing and construction and, to a lesser extent, in the service sectors of the economy. It is interesting to note that within the manufacturing sector, employment in durable goods increased substantially more than in nondurables.

Table II shows the percentage increase in employment, 1939–57, for the various sectors. The employment effect of the export boom perhaps can be summarized from this table alone: it has not been the export raw-material industries themselves which have provided the large increases in jobs, but rather, manufacturing, in general (but especially the export-oriented manufacturing industries) and the tertiary sector. Thus much of the increase in investment expenditures in mining, quarrying and oil wells noted earlier was providing employment in the manufacturing and construction sectors. The multiplier and accelerator effects of the initial investments in mining and oil wells and, of course, in the plants which process the output at least to some degree before exporting, thus provided jobs for the new workers; they did not find employment in the raw material industries themselves.

TABLE II

PERCENTAGE CHANGES IN EMPLOYMENT IN CANADA, 1939–1957

	Percent
Agriculture	−46
Forestry	67
Mining	36
Manufacturing	106
Wood products	74
Paper products	110
Non-ferrous metal products*	171
Non-metallic mineral products*	189
Construction	119
Trade	114
Finance, insurance and real estate	114
Service	132

* Percentage increase shown is for 1939–56 instead of 1939–57.

Source: Dominion Bureau of Statistics, *Canadian Statistical Review Supplement, 1957*, Tables 7, 9; *Canadian Statistical Review*, October, 1959, Tables 8 and 9; and *Canada Year Book*, 1957–58, p. 762.

Financing of Capacity Expansion

As we have seen, in the adjustment of the Canadian growth rate in response to external market conditions, net flows of foreign savings have usually played a key role. As the incentives to expand productive capacity have increased because of improved export prospects, resources available for investment have increased to a large extent. This has been accomplished by drawing on foreign resources rather than by diverting resources from consumption, exports, or government activities. Thus, net inflows of foreign savings have served to supplement domestic savings during periods of rapid expansion of capacity stimulated by improved export conditions. The recent experience of the 'fifties is no exception. The period of current account surpluses beginning in 1934 ended in 1950, and during the years 1950–58 the annual average deficit on current account was $682 million, or 12 percent of gross domestic investment.

The smoothness of the transfer process in the 'fifties has depended again upon capital inflows and imports being related to a common set of factors which influence domestic economic activity. First, demand for imports has risen relative to domestic production in prosperous periods and fallen during depressed periods. Table III provides some insight into the reason for the high-income elasticity of demand for imports. Imports of investment goods have always been a high proportion both of total imports and of fixed business investment. In recent years, these investment goods have been about 30 percent of total merchandise imports and about one-third of fixed business investment. Both figures have, in fact, been higher than in the prosperous year of 1928. A rise in domestic investment has thus led to a large rise in imports of investment goods. In addition, the

TABLE III

COMPOSITION OF CANADIAN IMPORTS, 1928, 1950–1958

Year	Percentage Distribution of Imports*			Investment goods imports as a percent of fixed business investment	Consumer goods imports as a percent of personal consumption of goods
	Industrial materials	Investment goods	Consumer goods		
1928.....	34.1	18.1	30.9	24.6	13.8
1950.....	31.6	22.1	29.8	29.1	11.3
1951.....	33.5	25.2	26.9	33.7	11.7
1952.....	28.1	29.8	27.5	34.6	11.1
1953.....	26.8	30.4	29.5	35.2	12.5
1954.....	26.0	29.8	30.9	34.3	12.2
1955.....	27.1	30.1	30.3	37.1	12.6
1956.....	27.0	32.7	28.6	35.5	13.4
1957.....	26.0	32.7	29.2	31.0	12.8
1958.....	25.8	30.1	32.7	30.4	12.7

* The first three columns do not add to 100 percent because a few items—fuels and lubricants, settlers' effects, Canadian goods returned, and military supplies for NATO forces—are excluded from the classification.

Source: Calculated from Bank of Canada, *Statistical Summary*, 1956, pp. 98–99; and, October, 1959, pp. 463–464; Dominion Bureau of Statistics, *National Accounts, Income and Expenditure*, various years. The import classification for 1928 was estimated from trade statistics.

ratios in Table III suggest that in boom years, the pressures on domestic capacity lead to a greater reliance on imports than is the case when capacity conditions are not as tight.

Secondly, to a large extent the rise in investment has been due to the occurrence of inflows of long-term foreign funds; and in some cases, businesses, especially foreign subsidiaries, import foreign capital in the form of machinery and equipment. Net direct investment inflows, which have been closely related to incentives to invest, have accounted for about 52 percent of net capital inflows during the period 1950–58. The bulk of direct investment has gone into the extractive industries where export prospects were particularly high. Net new issues of Canadian securities abroad have accounted for most of the other net capital inflow and have reflected changes in relative interest costs at home and abroad, which in turn appear to have been a good reflection of the relative profitability of investment in Canada.[6]

Because of the close interdependence of imports and long-term capital flows in the 'fifties, the Canadian dollar has traded at a premium over the U. S. dollar rather than at a discount—despite dramatic changes in the current account. With long-term capital flows offsetting current-account deficits, short-term capital flows have been, as a result of the confidence in this mechanism, generally stabilizing over the recent period. Thus, while the Canadian dollar, in terms of the U. S. dollar, appreciated after it was set free in 1950, it has remained relatively stable since 1952. The annual average of the spot rates on the Canadian dollar have been fairly steady within a range of a two to five percent premium over the U. S. dollar.

The recent period of growth has been similar to earlier periods in another respect. The deficits on balance of trade, as well as on current account during the 'fifties,[7] have cast doubt on the continually popular stage theory that economic growth in an open economy is necessarily associated with systematic changes in the balance of payments and economic structure which move a country from an immature debtor to a mature creditor.[8] The emergence of a balance-of-

[6] It is probably also true that some foreign investors have been motivated by news of a few high returns rather than by average returns on investment of new funds in Canada.

[7] The one exception is 1952 when a balance of trade surplus was recorded due to a sudden favorable shift in the terms of trade.

[8] For examples of continual homage to the debtor-creditor stage theory of economic development in international trade text-books see, C. P. Kindleberger, *Inter-*

trade surplus in the 'thirties and the net repayment of long-term capital in the 'thirties and 'forties were heralded as evidence of a new stage in the Canadian economic structure and of evidence of the role Canada would be playing in the support of foreign economic development through the next export of capital.[9] The recent large net-capital inflows and the high ratio of equity to debt capital in these flows will tend to perpetuate the Canadian debtor status, although the charge on foreign indebtedness is likely to fluctuate more closely with business conditions the higher the ratio of equity to debt.

On the one hand it is true, however, that deficits on balance of trade will not continue for long if, as is probably the case, the growth in interest and dividend payments in the current account exceeds the growth of net capital inflows.[10] On the other hand, unless there is a rise in the rate of domestic savings or a fall in the marginal capital-output ratio, continued current account deficits are necessary if the domestic growth rate is to be maintained.

Recent Growth Experience

One of the striking features of twentieth-century growth in Canada is not, therefore, that each prosperous period has been marked by a distinctive set of characteristics but rather that the growth adjustment mechanism has not been very different. The changes in the economic structure have not been so great that a simple, though admittedly crude, model cannot be used to analyze the main periods of Canadian growth during the twentieth century. The impact of external factors on the growth process has thus during the 'fifties borne many similarities to the period 1900–1913. It has been argued on the one hand that aggregate investment was beginning to decline because export capacity had finally caught up to demand, and, on the other hand, that the rate of growth of export demand was beginning to taper off. Primarily as a result of these two factors, the Canadian growth rate was becoming more sluggish, and if it had not been for the outbreak of World War I, the sluggishness would have become increasingly apparent.[11]

During the past two years, the Canadian growth rate has again shown some signs of weakening, but it may be argued that our forecasts of average growth over the next several years should not be influenced by recent experience of what has been accepted as a typical, mild, rhythmic movement in the growth process in North America. It is important, therefore, to consider the significance of the recent recession, especially since the 1953–54 recession was followed by a breath-taking period of economic growth.

With respect to both the size and duration of the decline in total output, the 1957–58 recession was less severe than the 1953–54 recession, and both were relatively milder than the recessions in the United States during the same periods. Both also spread through foreign-trade channels, but, in contrast to 1953–54 when agricultural exports experienced only a temporary setback followed by a drop in farm income and agricultural investment, the 1957–58 recession reflected a more serious softening of export demand for many products of the resource-oriented industries, such as metals, minerals and forest products. At the same time, due to the high rates of investment during the 'fifties, capacity output by 1957 had caught up to demand for output for the first time in

national Economics (Homewood, Illinois: R. D. Irwin, Inc., 1955), pp. 367–371; S. Enke and V. Salera, *International Economics* (New York: Prentice-Hall, Inc., 1951), pp. 501–506.

[9] Representative of widespread views in the 'thirties and 'forties is J. F. Parkinson's statement in 1940 that "the existence of a regular surplus of exports indicates that Canada has now reached a stage in its economic development appropriate to a 'mature debtor' country." "Canada's International Accounts and the Foreign Exchanges," in *Canadian Investment and Foreign Exchange Problems*, ed. J. F. Parkinson (Toronto: University of Toronto Press, 1940), p. 17.

[10] For a formal presentation of the rather unlikely conditions which are necessary for a borrowing country to continue to have deficits on its balance of trade, see E. D. Domar, "The Effect of Foreign Investment on the Balance of Payments," *American Economic Review*, Vol. XL (December, 1950), pp. 805–826.

[11] J. J. Deutsch, "War Finance and the Canadian Economy," *Canadian Journal of Economics and Political Science*, Vol. VI (November, 1940), pp. 525–537.

many of the resource industries. Emergence of excess capacity led to a sharp curtailment of further investment, and for the year 1958, business capital expenditures were 44 percent below the 1957 level in the forest- and mineral-products sector.[12] The main stimulus for a high growth rate, namely the expansion of capacity in resource industries—weakened at least temporarily. Fixed business investment declined relatively more in 1957–58 than in 1953–54, but imports of investment goods fell even more, ameliorating the effect on domestic output of producers' goods. Residential construction and government expenditures also served to bolster the economy. Residential construction had become an extremely important sector through which monetary policy was felt in the economy. As yields on financial assets rose during the tight money period 1955–57, the attractiveness to financial institutions of government-insured residential mortgages became less attractive due to the ceiling on the yields of such mortgages. As yields on financial assets declined during the recession and as more government funds were made available for direct lending by the Central Mortgage and Housing Corporation, the flood of pent-up demand was released and expenditures on residential construction rose by 25 percent in 1958 over 1957. The new Conservative government also increased government expenditures throughout the recession. Thus, public action played a greater role in the recent recession in halting the decline in output, but it was essentially temporary action. During the latter half of 1958, and during 1959, a substantial rise in output has occurred, and is expected to continue to occur in 1960, but growth forces have been weaker than in the period following the 1953–54 recession.

The Outlook

Despite a slight retardation in the last couple of years, the 'fifties have, on the average, been years of extremely rapid growth in Canada. The basic question of whether this average growth rate will be maintained in the early 1960's or whether there is evidence that the growth rate will have to adjust to a somewhat lower level still remains. The answer will undoubtedly hinge, as it has in the past, on the economic conditions of Canada's closest trading partners and on the nature of the Canadian adjustment mechanism. Without attempting to forecast foreign economic activity, let us accept, at least initially, the view expressed by many economists that the early 'sixties will be a period of rather sluggish growth in the U. S. We can then consider the probable outline of Canadian growth by combining this assumption with our knowledge of recent structural relations, inadequate as our knowledge of the latter may still be.

The foreign growth rate, particularly the growth rate of the U. S. economy, probably will be the most important determinant of growth in Canadian exports in the next few years, although shifts in foreign tastes towards or away from Canada's highly specialized bundle of exports, changes in foreign commerical policy, and competition from foreign sources of supply may alter the relation. It is doubtful, however, if we can reasonably expect Canadian exports to rise relative to United States output. It is true that Canadian export capacity has been built up in the 'fifties to the point where we can expect intensive efforts to capture a higher proportion of foreign demand. For most of Canada's main export items, however, foreign competitive sources of supply have also expanded greatly, and the competitive effects have already been made apparent recently, for instance, in Canadian exports of minerals which have been under pressure because of general excess capacity in the world. With a fairly low rate of growth in the United States, a lowering of tariffs and other import restrictions in that country

[12] Canada, Department of Trade and Commerce, *Private and Public Investment in Canada*, Outlook 1959 (Ottawa: Queen's Printer, 1959), p. 7.

would appear to be unlikely. Moreover, a very significant strengthening of world markets and prices for agricultural products does not appear to be in sight. Finally, the development of European regional tariff preference systems will not have a significant effect on Canadian exports because of the types of Canadian products exported,[13] so we cannot expect the possibility of a higher growth rate in Europe than in the United States to stimulate greatly the growth of Canadian exports. As a result, exports are not expected to grow faster than United States GNP, which in turn means a lower rate of growth of exports than during the prosperous years of the 'fifties.

Partly as a result of export prospects, the rate of increase of investment expenditures and the ratio of investment expenditures to GNP are expected to decline slightly. Since productive capacity is high in relation to export demand, and there is no evidence of a very strong rise in export demand, capital formation in industries related to export trade probably will not show the dramatic increases of most of the post-World War II period. However, there will be offsetting factors. First, tight credit conditions since the end of 1958 have probably served to spread investment expenditures by some industries, such as utilities, over a longer period of time rather than to force abandonment of investment plans. Secondly, increased liquidity of business firms from rising profits since the 1957–58 recession should lead to some stimulation of investment. Thirdly, if, in a relative sense, there is some release of resources from the construction of productive capacity in resource industries, a keener competition will develop to shift some of these resources to construction in other sectors. Thus, even with a continuation of tight credit conditions, more favorable bids, for instance, on construction contracts may encourage capital formation in some areas that in recent years have been in a relatively weak bargaining position for resources. School construction and certain other social capital expenditures might well expand a bit for this reason.

With respect to expenditures on residential construction, public policy will continue to plan an important role in its fluctuations, but in general, the average rate of increase will not be very great until the mid-'sixties. Residential construction as a proportion of GNP averaged 4.7 percent during the period 1950–58, which is a little higher than we would expect during the following three or four years. Apart from credit conditions, the major influences bearing on this sector will be the stock of houses, the rate of family formation, and the growth of *per capita* disposable income. Because the rate of housing construction has been higher since 1945 than that of family formation, the abnormal supply condition that existed at the end of the war has been dissipated. The rate of family formation will be rather low for a few years until the higher birth rate that has existed since the end of the 'thirties begins to be reflected in a very high rate of family formation during the mid-'sixties. In addition, the rate of net immigration, an important source of housing demand, has tapered off since 1957 and is unlikely to be as relatively significant during the next few years as it was during the period 1950–57. It is true that the expected rise in *per capita* disposable income will stimulate housing demand just by reducing crowded conditions and increasing replacements and major improvements, but the income elasticity of demand for housing is undoubtedly less than 1.0. In general, then, while both residential construction and business investment will be moving upwards in absolute terms, a rate of increase of the size which characterized much of the 'fifties is not expected.

Consumption expenditures are expected to provide a strong and relatively stable basis for economic expansion, and an annual average rate of increase of about 5 per-

[13] R. E. Caves, "Europe's Unification and Canada's Trade," *Canadian Journal of Economics and Political Science*, Vol. XXV (August, 1959), pp. 249–258.

cent during the period compared to about 6 percent in the 'fifties is expected. Several reasons in addition to the historical stability of the rate of increase can be cited. No serious depression with levels of unemployment above the recent recession level is foreseen, and personal income is expected to have a highly stable rate of increase. In addition, tax rates are not expected to rise and, if anything, will be lowered slightly. With regard to expenditures on consumer durables in particular, the possibility of some lengthening of repayment periods offered on consumer credit financing may serve to add extra strength to this sector, but the big rise in consumer durables will probably not occur until the rate of family formation increases in the mid-'sixties.

With respect to government expenditures, our impression is that expenditures by provincial and municipal governments will show a more rapid rate of increase than federal expenditures, though the increases may be at a slightly lower rate compared to recent experience because of a reduction in the lag of municipal services. On the federal level, the present government's philosophy suggests that large increases of expenditures are unlikely. Defense expenditures, assuming no increase in international tensions, will be roughly stable in absolute terms and will continue to decline as a percent of total government expenditures. In the absence of a serious downturn of business activity, non-defense expenditures will probably be held to a rate of increase which permits a slight reduction in general tax rates and at the same time avoids budget deficits. Since forecasting government expenditures requires a forecast not only of business conditions but also of policy reactions to changing business conditions, the above conclusions are highly tentative. It does appear, however, that the new government's "vision" of massive projects to open the Canadian north and of expanding rapidly certain types of government expenditures for this purpose has become dimmer. In the future, a resurgence of export prospects for minerals and metals which would make extensive development of the north economical may well be one of the chief determinants of a marked increase in government expenditures.

We have argued that past evidence supports the hypothesis of treating merchandise imports as an endogenous variable determined not only by the growth of total output but also by the ratio of investment to output, domestic capacity conditions, and relative prices. Thus, a slower rate of growth of investment and slight decline in the investment-output ratio will tend to depress the rate of growth of imports. At the same time, a further retarding factor will be the expansion of productive capacity, particularly in the manufacturing sector, which has occurred in the 'fifties. The absence of strong pressures on capacity also will serve to prevent very significant increases in domestic prices relative to import prices, although the role of the balance of payments adjustment mechanism will be considered below. In general, while these factors suggest that the rate of growth of merchandise imports will not be as high as in prosperous years of the 'fifties and will not be above the rate of growth of output, continual current-account deficits are expected. As servicing of foreign capital imported in the 'fifties gains in significance, interest and dividend payments are expected to be a higher proportion of current-account payments than during the 'fifties.

In summary, the somewhat lower expected rate of growth of exports during 1960–62 coupled with the present state of capacity in export and export-related industries will tend to reduce the rate at which investment and GNP expands relative to the 'fifties. The expected growth in consumption expenditures, residential construction, and government expenditures does not appear to be great enough to offset this. These outlays themselves reflect conditions in export markets and in fixed business investment. At the

same time that investment is reduced slightly as a percent of total output, it is expected that net deficits on current account as a percent of total output will fall also, although deficits will continue to be a feature of Canadian growth.

Will these deficits be financed easily by international capital flows, or is there likely to be some pressure on the Canadian exchange rate? The answer must be couched at best in terms of probabilities. In contrast to the last half of the 'forties when balance-of-payments difficulties were last experienced, it can be said that foreign investors have "rediscovered" Canada and that the habits and institutions connected with foreign-investment inflows will, together with confidence in continued economic and political stability, produce a strong current in the flow of funds to Canada. On the other hand, we have noted that the bulk of foreign-investment inflows, especially of direct investment, have been attracted in the 'fifties by development of resource industries, and we now expect returns on investments in this sector to be lower for a while. The Canadian dollar was worth a little over $1.05 U. S. in December, 1959. However, available statistics suggest that short-term capital flows played a relatively more important role in 1959 than previously in financing the near-record current-account deficit and in sustaining, and even pushing upward slightly, the value of the Canadian dollar. There appears to be more than a 50 percent chance that some pressure on the Canadian dollar will develop in the near future but that several adjustments will prevent a fall much below parity with the U. S. dollar. First, domestic production of import-competing products is in a stronger position now than a decade ago, and a depreciation of the exchange rate will stimulate further production of such products. Secondly, new issues of securities abroad have been highly sensitive to relative costs of borrowing at home and abroad and are therefore influenced by the costs of converting foreign funds into domestic. Thirdly, there will be some incentive to defer payments on foreign capital invested in Canada. Finally, while the price elasticity of demand for Canadian exports appears to be rather low in the short-run, a lower value of the Canadian dollar for a longer period will undoubtedly provide some increase in exports.

Conclusions

The process of growth in Canada has borne recently, and will continue to bear over the next few years, marked similarities to the mechanism of the past. Apart from minor fluctuations (which we do not attempt to forecast), the growth rate in the early 1960's will be a respectable one on the average but will be lower than the 5 percent rate of increase in real output experienced during most of the 1950's. This conclusion is based, however, on the assumption that growth in the United States will not jump to a rate much above the average for the past four years.

The adjustment mechanism will continue to work rather smoothly, although it appears that some slight downward pressure on the Canadian dollar will occur.

It does not appear that the next few years represent a prelude to a longer period of serious stagnation, since a number of factors point to a rise in the growth rate again in the mid-'sixties.

Unfortunately, unlike forecasters of the long-run, we cannot find solace and escape from embarrassment in Keynes' truism about the long-run and mortality. Nevertheless, an intermediate-range forecast for the next three or four years may be of some practical significance, both because of the rather short time horizon of policy decisions and because of the need for refurbishing constantly on the basis of empirical tests the meager store of forecasting tools.

Quantitative Methods in R&D Management

RAOUL J. FREEMAN

A report on one of science's latest gifts to managers—the application of quantitative techniques to R&D management problems.

A new tool to aid the research-and-development manager has emerged in the past few years. That tool is the application of quantitative techniques to management problems in the R&D area. Though the subject is a relatively new one, such techniques as programming models, network-flow models, man-hour analyses, and evaluation formulas are developing rapidly.

Because all of these techniques have been designed to aid managers by clarifying complex R&D situations, businessmen's interest in this new field has accelerated greatly in the past few months. Here is a report on and an analysis of the latest research developments in this timely study.

Programming Models

The "constrained maxima-programming" type of model, which is usually formulated on a stochastic basis, tries to find answers to the dual questions of how much to spend for research and how to allocate it among projects. The pioneer work in the application of this approach was done by this author.[1] Net worth or value of research programs (sets of experiments) are derived from values of individual experiments. Then the best of all possible programs is selected by the procedure. That is, the optimal budget among projects is then ascertained from data used in arriving at the best budget decision.

Research-and-development management is viewed as having the task of picking m out of N proposals upon which to work in the forthcoming period. Estimates of net worth are attached to these proposals. Here is an example of the form that such an estimate might take:

> Expected discounted potential profit from sales and royalty payments + expected value of retaining or bettering market position or prestige − expected discounted cost of research and development.

The above factors would have to be suitably quantized for each individual form. It is probably more realistic to require a probability distribution of possible values of the above quantities. A pessimistic, likely, and optimistic value might be all that would be necessary.

The distributions of the above factors will be influenced by the time difference between when a firm and its competitors complete a product. This is taken into account in the models. The variation in value, time, and amount spent for an individual experiment is also handled by the technique.

Estimation by individuals always tends to introduce bias. However, statistical methods can be introduced to correct estimates on basis of the comparison of past estimates and actual results. Such "temporization procedures" are also utilized in the model.

An integral part of the procedure rests on an appropriate definition of "types" of experiments. Such a classification is an attempt to find characteristics that projects have in common which, on the average, will portray some time invariance.

[1] See Reference 12.

The models are general enough so as to be able to handle sequential considerations created by certain experiments extending over more than one budget period. However, fundamental research cannot be accommodated by the procedures either in one or several budget periods.

Research and development management is faced with a given amount of resources (money, personnel, and physical facilities), the amounts of the above resources needed by each of the N experiments, and the predicted values of the N experiments. Their problem is to pick the optimal set of experiments, m ($\leq N$).

Thus, a decision must be reached for each proposal as to whether or not it will be undertaken while making certain that the entire operation stays within budgetary and other constraints. In essence, we have a constrained maxima problem of a simple type. It is a discrete programming problem with strict limitations on the range of the variables, known as a "yes-no" problem. What we seek are values of 0 or 1 for characteristic variables x_i assigned to each project. The following numerical example will help to clarify the procedure. A mathematical treatment is given in Appendix I.

Table I shows the potential experiments,

TABLE I

Experiment	Value	Cost
1	32.0	8
2	28.0	8
3	20.8	12
4	16.0	12
5	28.0	16

their discounted temporized, expected value estimate, and their discounted temporized expected cost estimates.

Table II shows the cost of providing various research budgets (in terms of additional capital expense to obtain a given budget).

For a given budget we calculate the best set of experiments (i.e., those which maximize the total value and yet whose cost is less than or equal to the budget). This is done by means of discrete programming. In this simple example, the reader can, by common sense methods, check the optimality of the results.

TABLE II

Budget	Additional Capital Cost	Total Budget Cost
40	0	40
44	4	48
48	8	56
52	12	64
56	12	68

We now calculate the total value of each optimal set of experiments by summarizing the values of the individual component of the set. It is assumed that the total value is simply the linear sum of the individual values. This assumption is not necessary in the general procedure.

TABLE III

Budget	Optimal Set of Experiments
40	1, 2, 3, 4
44	1, 2, 3, 5
48	1, 2, 3, 5
52	1, 2, 3, 5
56	1, 2, 3, 4, 5

We now calculate the net profit that can be derived from each of the potential budgets.

TABLE IV

Budget	Value of Optimal Set
40	96.8
44	108.8
48	108.8
52	108.8
56	124.8

We can now select the most optimal budget, which is 44. The optimal set of experiments from Table III is then 1, 2, 3 and 5.

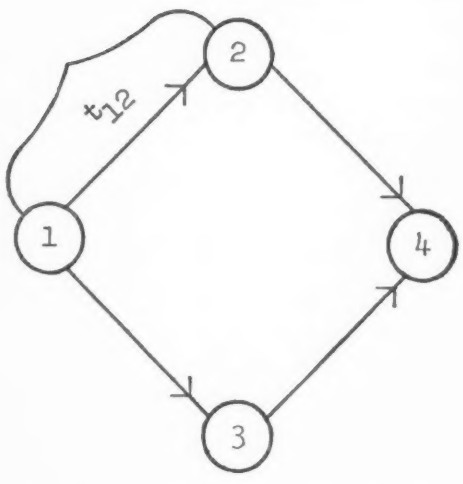
TABLE V

Budget	Net Profit = Value of Optimal Set − Total Budget Costs
40	56.8
44	60.8
48	52.8
52	44.8
56	56.8

Network-Flow Models

The original purpose of the network-flow type of model was as a prediction and control device with regard to time of completion of R&D projects. However, generalization may make it possible for it to be used as a planning tool with regard to resource expenditure, performance requirement, and time.

Figure 1



In this conception, it is assumed that an ordered sequence of events to be achieved constitutes a valid model of an R&D project or program, and that a directed network of events has been defined for the project under consideration. Following, we define an event as a distinguishable, unambiguous point in time that coincides with the beginning and/or end of a specific task or activity in the R&D process.[2] Elapsed time estimates are obtained for the amount of work necessary between events (See Figure 1.). For example, t_{12} indicates the time for the activity between events 1 and 2. More details regarding the estimates are given in Appendix II.

One of the first steps in organizing the data in the PERT approach consists of making a sequential listing of events. In other words, no event is placed on the list prior to any other event that must precede it. This tends to collapse the network picture into a linear array.

The estimate of the expected time at which an event will be accomplished (a function of expected completion times for events which must precede it) is computed by examining all events that must immediately go before, taking the longest expected time in this group and adding the expected time for the activity which relates that event to the one under consideration.

From the above definition of expected time, it is evident that there will be slack in the system. In other words, some events could be completed later than their expected time without holding up the progress of the entire project. There are, however, "latest times" for each event. If an event takes longer than its "latest time," then it causes a delay of the entire network. Slack is defined as the difference between the expected and the latest times. Of course, life would be changed if slack were defined as the difference between "optimistic latest time" and expected time.

The "critical path" of the network is defined as a directed path through the entire network consisting of "slack-zero" events. Should any event on this path slip beyond its expected time, then the final event can expect to slip a similar amount.

[2] See Reference 12.

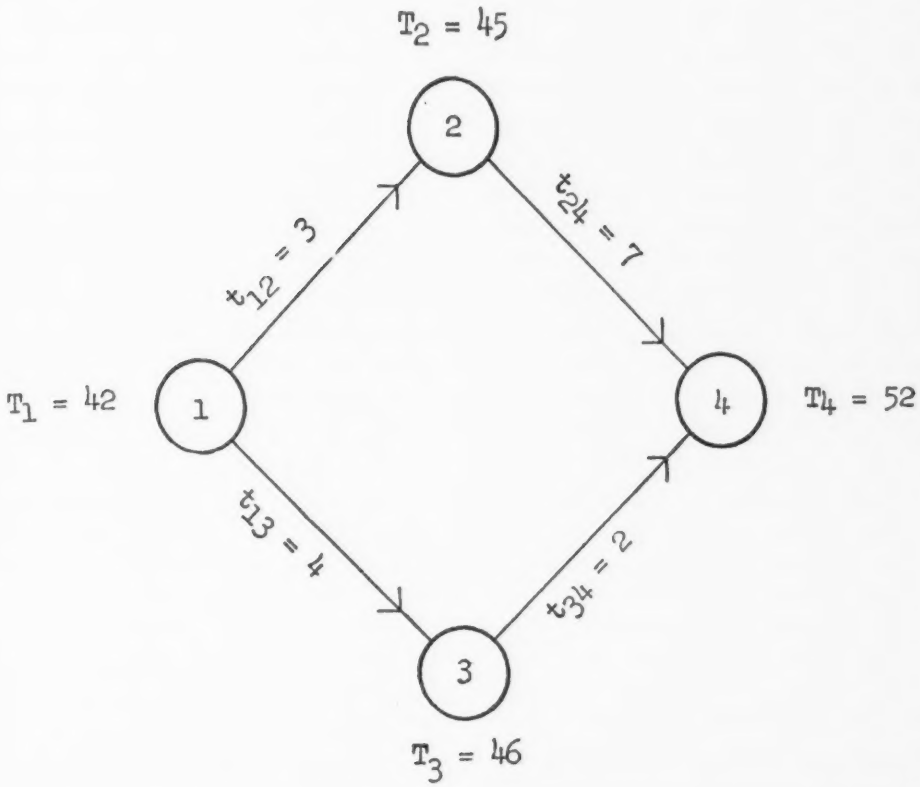
As an illustration of the above, let us consider Figure 2.

Where t_{ij} = expected time to complete activity between events i and j.

T_A = expected time necessary to reach event A.

The critical path is [1 – 2], [2 – 4]. Latest time for event 3 is $T_4 - t_{34}$ or 52 – 2 = 50.

Figure 2



Slack at event 3 is $T_L - T_3$ or 50 – 46 = 4.

By means of this model, the expected length of time necessary to complete the entire project can be estimated, the gross effect of delays in various parts of the project can be calculated, and the probability of meeting an existent schedule can be established.

The success of the network model depends on the input of a fairly detailed network diagram of the R&D project or program under consideration. If this is provided, then it seems as reasonable to ask for cost as well as "time to completion" estimates of the various links in the network. Furthermore, all time and cost estimates are based upon a specified technical objective or a level of technical performance. In essence, then, if the people questioned can be expected to give estimates for one level of technical performance, then there seems to be no reason why the latter couldn't be varied and they be requested to give time and cost estimates for a series of technical performance values. Thus, in essence, we could have three factors variable: cost, time, and technical performance. The latter might really be a vector including such elements as power, reliability, speed, etc.

Given that the above estimates could be

obtained, there still remains the problem of finding a measure of effectiveness for these three diverse quantities. To find a function which will do a pin-pointing job in this direction is bound to be difficult. However, I think it would be reasonable to ask management for a "trade-off" function over a large range of each of these variables. Ultimately, one could hope to arrive at a group of values which, for the reason of management's inability to differentiate between them all, would be called optimal.

The object of the manipulator of the generalized PERT system then would be to see to it that in the planning of requirements for the project or program, one of these optimal courses of action is selected. A more complex mathematical procedure than the one suggested in "Application of a technique for Research and Development"[3] will be needed, since three values will be attached to every link. It would seem that the network flow algorithms of Ford, Fulkerson, etc., would be appropriate. Furthermore, there would probably be quite some difficulty in finding the effect on technical performance, P, of the entire project from small change, $\triangle p$, in the technical performance of a link. However, we feel that work along these lines could be fruitful and that some effort towards a generalization of PERT would be highly rewarding.

"Man-hours" Analyses

Some of Kaplan's work in man-hours analysis is typical of efforts in this area.[4] He divides the process that an R&D project passes through into four stages. These are:

1. *Research and Engineering.* The initial stage of the job of where the broad specifications of the item to be built are transferred into ideas for components having specific functions. The size, shape, and function of each component is evaluated in terms of engineering criteria to ensure that it, as well as the entire system, will perform to meet the specifications in the particular job under study.

2. *Design.* The stage of the job where the engineer can turn the concept of a component or a set of components over to a designer who, in general, will have a high amount of practical design experience, although not necessarily an engineering degree. The designer is responsible for translating rough engineering sketches and concepts into more finished and specific layouts and to supervise the detail drawings of the component.

3. *Detailing.* The stage of the job where the detailed drawings of each component are produced. The detailers are primarily draftsmen who work under the close supervision of the designer.

4. *Checking.* The stage of the job where the detailed drawings are checked against the designer's drawings, against engineering criteria, and against specific job standards. This is a relatively high-level job compared to ordinary detailing with the pay scale for checkers being about the same for designers.

Kaplan was concerned with trying to estimate the total man-hours on R&D projects, and he looked for invariant characteristics among R&D projects. He found from the small sample of data that was available that the number of detail drawings for a job could be estimated with great accuracy. From this number one can estimate again with great accuracy the number of man-hours required to do the detail drawings. Kaplan found a linear relationship between "detailing" hours and "design and checking" hours.

He then obtained another linear relationship between "design and checking" hours and "engineering" hours (up to the point where the main body of design work has been completed). There were, however, different linear fits for projects in whose type the laboratory had had earlier experience and those in which it had not.

[3] See Reference 12.
[4] See Reference 10.

Although Kaplan's results are probably not generally applicable, his methodological approach was a good one. The search for invariant characteristics of R&D projects on any level of abstraction is the right path along which to proceed.

Evaluation Schemes

Some other schemes which have been used for quite a while but which seem to be coming back into vogue are the so-called "evaluation formulas." These concentrate about R&D project characteristics such as promise of success, time to completion, cost of the project, strategic need, market gain, etc. The estimates made of these factors are usually transformed by some arbitrary means into a set of numbers ranging from, say, 0 to 10 or 0 to 3. Best projects are defined as those having the highest sum or product of the transformed numbers, and the optimal set of projects is made up of all those with the highest rating which in total cost are less than the amount to be spent for research.

An example of an evaluation scheme can be found in Table VI.

TABLE VI

Criteria	Rating by Expert	Numerical Value of Rating
Promise of success	Unforeseeable....	1
	Fair	2
	High	3
Cost.....	over 100,000	1
	10,000–100,000	2
	less than 10,000	3
Time to Completion.....	more than 3 years	1
	1 year to 3 years	2
	less than 1 year	3

Thus, a project which has a high probability of success, costs less than $10,000, and will be completed in less than one year would derive a rating of 27 = (3)(3)(3) if a multiplicative scheme were used, or 9 = 3+3+3 if an additive scheme were used.

The unsatisfactory aspect of these evaluation schemes is the arbitrariness of the transformation procedures, and the doubt that arises as to whether they reflect the true profit objectives of the firm.

The SCARDE Study

Data are needed for the final stages of conceptualization of the present methods, for the formation and development of new models, and for the testing of various methods. The necessity for comprehensive data on all aspects of the R&D process was foreseen by the workers in the field, and an intensive data-gathering project was initiated. It is called the SCARDE Study.

SCARDE, the Study Committee for the Analysis of Research, Development and Engineering, has a membership composed of representatives from industry, government, and the academic community. SCARDE's purpose is to conduct a comprehensive study to collect pertinent and meaningful data on the behavior of applied research, development, and engineering activities, and to make these data available to industry and the scientific community for further study. Emphasis is based on quantitative data and measurement on the individual project level.

The motivation for the study lies in the belief that there are regularities in R&D activities, and that it is, therefore, possible to extract information from the past (i.e., completed projects). It is hoped that the work will point up similarities and differences among diverse projects, and that these findings will suggest further research on the behavior of variables which a manager can control.

The specific areas in which data are being gathered include:

(a) Total effort expended on phases of various types of big industry and by size of firm

(b) Project organization

(c) Evaluation of the final product and the performance of the project's work
(d) Random events which influenced the project
(e) Relation of estimates to actual figures.

Project data are being collected by or under the guidance of members of SCARDE in their respective organizations. The cooperative work of knowledgeable and interested persons at the project level is the only mechanism that can provide meaningful data in a reasonable time period. Ultimately, it is expected that data will be gathered on several hundred projects.

Conclusion

This paper has undertaken to survey some of the activity in the field of applying quantitative methods to R&D management. Interest in this field is far, far greater now than it was several years ago, and we who are working in the field look forward to ever increasing scientific effort in the area. We believe that the fruits of this labor, as far as practical applications are concerned, will begin to blossom in the very near future.

All the work in the field is intended as an aid to and not as a replacement of management. Nowhere is the intuitive brilliance of good management so necessary and crucial as in the research and development area. Quantitative techniques act as a helping hand to R&D managers, and by clarifying complex situations, they stimulate the rare flashes of insight which make for successful research and development control.

APPENDIX I

We wish to:

(1) Maximize $\sum_{i=1}^{N} v_i x_i$

(2) Subject to $\sum_{i=1}^{N} c_i x_i \leqq A_\lambda$

$$\sum_{i=1}^{N} b_{ij} x_i \leqq F_j \qquad j = 1 \cdots h$$

$$\sum_{i=1}^{N} d_{ij} x_i \leqq K_j \qquad = 1 \cdots g$$

$$x_i = 0 \text{ or } 1$$

where,

x_i is the characteristic variable of the i-th project
v_i is the atom of the i-th project,
c_i is the cost of the i-th project
A is the total allocation for research,
F_j is the amount available for the j-th facility resource,
b_{ij} is the amount needed by the i-th project of the j-th facility resource,
K_j is the amount available of the j-th personnel resource,
d_{ij} is the amount needed by the i-th project of the j-th personnel resource.

Other restrictions, such as making sure certain people are assigned to specific jobs, that enough capital will be available to exploit the results of the research, etc., may be added. As long as the additional constraints are linear, the computational burden is not increased too much.

The "yes–no" problem may be solved using the methods of discrete programming, yielding the optimal set of projects (those with $x_i = 1$). Then the total worth of this optimal set is given by the functional, (1). Let us call this total worth W_λ. Thus, we have now derived an optimal course of action for appropriation A_λ, yielding total net worth or "value" W_λ.

In order to decide what appropriation to make for research, it is necessary for management to know the relation of W_λ to A_λ for all λ (practically speaking, for all in a certain range say, $1, 2, \cdots, R$). But, notice that we have a method for

obtaining this. If we solve R "yes–no" problems, then we can ascertain the relationship between A_1, and W_1, A_2 and W_2, $\cdot \cdot \cdot$, A_R and W_R. The optimal research budget is then determined by calculus methods from the latter data. Furthermore, the distribution of this optimal A_λ among projects has already been determined from the previous work.

A further A_λ innovation that may be introduced at the price of additional computation is the changing of the F_j or K_j values. For instance, if the appropriation is increased from A_λ to $A_{\lambda+1}$, then we may keep A_λ constant and use $A_{\lambda+1} - A_\lambda$ to change K_λ to $K_{\lambda+1}$ (e.g., hire a consultant). Thus, the W may be thought of as the value achieved by the optimal changing of the constraints.

The method of variation of constraints in the economic programming problem so as to derive the relationship between the value of the functional (i.e., output) and the varying resources (i.e., input) is very fundamental, and shows how the bases for macro-decisions are based on micro-data. After all, the W_λ, which play such an important role in the analysis, are functions of the values of the individual experiments. The following numerical example will tend to illustrate the model discussed heretofore.

APPENDIX II

Actually, three estimates—optimistic, pessimistic, and most likely—are obtained for each activity. Malcom, Roseboom, Clark, and Fazar fitted beta distributions to the time estimates, and developed equations which can be solved for the expected time and variance thereof.[5] These are:

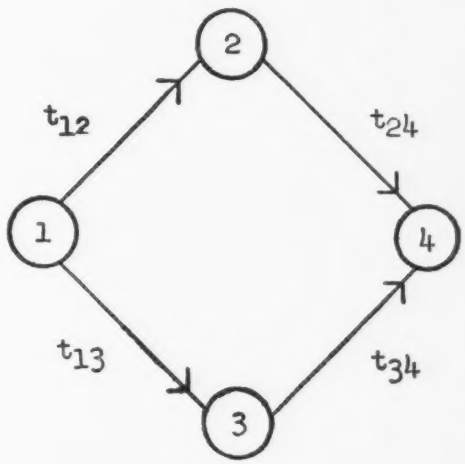
$$t_e = \tfrac{1}{2}\left[2m + \frac{a+b}{2}\right]$$

$$\sigma^2_{t_e} = \frac{(b-a)^2}{6}$$

Where b = pessimistic estimate
a = optimistic estimate
m = likely estimate.

It can be that an event can be accomplished in more than one way. For example, the activity [1 − 4] (See Figure 3.) can be done in two ways: [1 − 2] + [2 − 4], and [1 − 3], + [3 − 4]. In such cases, the authors mentioned above chose to utilize the greatest expected value on a time basis. Thus, the value for [1 − 4] would be $max\ [t_{12} + t_{24}, t_{13} + t_{34}]$. The variance of t_{14} is the sum of the variances of its component parts, either those of t_{12} and t_{24} or t_{13} and t_{34}. Of course, the above tends to give biased estimates, but those authors feel that the simplification is justified.

Figure 3



[5] See Reference 12.

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Why the British Shelved Compulsory Arbitration

ERIC G. A. ARMSTRONG

An account of Great Britain's 19-year experience with compulsory arbitration as a means of solving labor disputes—why it did not work there and why it probably would not work here.

Although the recent steel dispute in the United States was settled without further recourse to strike action, discussion continues about the possibility of introducing some form of compulsory arbitration as a means of solving industrial disputes. While the implications of compulsory arbitration are fairly well recognized, there is much that U.S. business and union leaders could learn from the experience of Great Britain, which abolished compulsory arbitration some months ago after nearly 19 years of operation.

Some form of compulsory arbitration existed in Great Britain during the First World War; however, it was abandoned in 1919. The Second World War prompted its re-introduction. After the fall of France in 1940, it was obvious that hostilities would continue for a number of years, and uninterrupted production was of paramount importance.

The trade unions and employers, therefore, agreed to renounce their ultimate sanctions of the strike and lockout; the renunciation was embodied in the Conditions of Employment and National Arbitration Order, 1940. Briefly, this legislation provided that where negotiations broke down, *either* party was free to report the dispute to the Minister of Labor who might then refer it for settlement to an independent arbitration tribunal. The Minister had 21 days within which to take such action, and during this period, any strike or lockout would be illegal. If the Minister, however, had not referred the dispute to arbitration by the end of the stipulated period, a strike or lockout could be called without fear of prosecution. The awards of the arbitration tribunal were legally binding.

This legislation, designed to meet the needs of wartime conditions, continued in operation until 1951, six years beyond its expected life span. The years 1945 to 1951 entailed a national struggle for economic survival and neither employers nor trade unions seemed ready to press for the removal of legal restrictions from their traditional weapons of lockout and strike. Two major factors possibly prompted this self-denial. There was a widespread recognition of the importance of the export drive and there was a reluctance on the part of the trade unions to embarrass the Labor government, formed from the Labor Party which the trade unions had helped to develop and largely finance. The right to lockout was no longer of great significance in industrial relations.

In 1951, however, when some strikers were prosecuted, pressure from the trade unions was instrumental in causing the Labor government to scrap the wartime Order and to restore the unfettered rights of the strike and also of the lockout. The fact that six years after VE day, strikers could still be prosecuted had become repugnant to general opinion. However, compulsory arbitration was not scrapped completely. A modified version, known as the Industrial Disputes Order, was introduced as an experiment in the same year.

While the new Order preserved some of the features of the wartime legislation, a number of important changes were made. The term "compulsory arbitration" usually implies the prohibition or some curtailment of the right to strike. This was not the case with the 1951 Order. Furthermore, the Minister of Labor was not empowered to compel the parties involved in a dispute to resort to arbitration.

Nevertheless, two elements of compulsion were built into the new law. Only one party needed to report the dispute; if *both* parties wished to resort to arbitration, then other procedures were available. There was thus compulsion on the reluctant party, generally the employer (this was for the most part a period of full employment and consequent union initiative), to present its case to arbitration unless it wished its claim to go by default. The award, once made, became an implied term in the individual contracts between the employers and workmen concerned. The non-observance of an award, therefore, would constitute a breach of the employment contract, establishing for the injured party the right to sue for damages in a civil court. Unlike its predecessor, the 1951 Order contained no penal sanctions. While the main purpose of the legislation was to provide a peaceful means for the settlement of disputes, the Order also contained important subsidiary purposes.

Only employers or trade unions, and in some instances an employers' association, could report a dispute. This restriction was a clear encouragement to the development of collective bargaining, for as far as work people were concerned, only a trade union could make use of the procedure. In addition, in some circumstances it might be to the advantage of an employer's association to have a non-member firm compelled to observe conditions of employment established by the relevant prevailing agreement to which the association was a party. This feature of the Order may well have induced a number of firms to join their "trade unions," the appropriate employers associations, and thus brought about an extension of the application of collective agreements.

This Order was introduced as an experiment, for compulsory arbitration in peacetime conditions was alien to the British conception of sound industrial relations. Mr. Alfred Robens, the then Minister of Labor, underlined this point in the House of Commons in 1951: "If at any time either side wish it to be discontinued it will be reviewed immediately."

As the years went by, employers' dissatisfaction with the operation of the Order increased. In addition to the standard objection to compulsory arbitration in peacetime as being an alien practice, the employers' main complaints were as follows: The tribunal had tended to be too generous to the trade unions; while the awards were legally binding it was far easier to enforce an award against one employer than against his 10,000 employees; where an award "unfavorable" to workpeople was accepted by them, this did not prevent an almost immediate application for further concessions. For these reasons and for others of an administrative nature, the Order was abolished and the arbitration tribunal finished its work early in 1959.

Responding to trade-union pressure, however, and with employers' acquiescence, the government introduced new legislation early in the summer. An act of Parliament is now in force which places on a "permanent" basis those provisions of the 1951 Order which enabled a "sub-standard" employer to be brought into line with employers in the same industry who were paying union or equivalent rates of wages.

The above is a brief and simplified history of the mechanics of compulsory arbitration in Britain in recent years. What is more interesting, possibly, to people in the United States who are concerned with industrial-relations problems are the lessons the British

have learned from the operation of compulsory arbitration and the relevance of such experience to American conditions. Before considering this aspect, two further points should be made.

There has long been a tradition in Britain of submitting to arbitration disputes arising from claims to alter existing agreements. Unlike the arbitration process in the U.S., where it is almost exclusively interpretative of existing contracts ("rights" arbitration), arbitration awards in Britain have often established new agreements, involving increases in wages and reductions in working hours ("interests" arbitration). It should also be borne in mind that, broadly speaking, the collective agreements reached in Britain between employers and trade unions are gentlemen's agreements only, un-enforceable by law. Such agreements are as strong as the voluntary support given to them by the parties concerned.

What, then, does British compulsory-arbitration experience suggest which may be of value to American discussions on this subject? While a comprehensive study of the operation of compulsory arbitration in Britain has yet to be completed, the following results are fairly clear.

Formulation of Compulsory Arbitration Legislation

As already mentioned, compulsory arbitration was not introduced in Britain in recent times until 1940, when the war had reached an acutely critical stage. In such circumstances, it could be claimed that Parliament would have been justified in rushing through legislation which would have imposed compulsory arbitration on employers and trade unions without paying heed to their viewpoints. Such a policy was not pursued. In fact, the 1940 Order was based on the *unanimous* recommendations of the representative national bodies of organized employers and labor, the British Employers Confederation, and the Trades Union Congress. Admittedly, the only too apparent needs of the national interest quickened agreement, but in 1951 the same procedure was followed when the experimental Industrial Disputes Order replaced the wartime measure. The Industrial Disputes Order was also based on an agreement reached between the B.E.C. and the T.U.C.

In other words, governmental policy in war and peace has been to associate both employers and trade unions with the law-making process. It might be said that the consequent legislation was a mere formalizing of the codes of conduct to which employers and their workpeople were prepared to subscribe. Perhaps this can be successfully achieved only when parity of status and strength has been attained by organized employers and workpeople and the functions and behavior of both are in a wide measure acceptable to the general public? Conversely, can compulsion be effectively applied if one or both parties are hostile to such a policy, irrespective of the condition of the public temper?

What Constitutes a Dispute?

Any discussion on compulsory arbitration should immediately prompt the question, "What is an industrial relations dispute?" Without entering into technicalities, it is true to say that experience in Britain during 1940–51 clearly showed that certain disputes could not be satisfactorily resolved by arbitration. For this reason, the definition of dispute in the 1951 Order was narrower than that given in the 1940 Order. The Industrial Disputes Tribunal was not empowered to arbitrate on disputes arising from the non-recognition of a union, the membership or non-membership of a union, alleged victimization or redundancy. Some of the most frictional areas in industrial relations were therefore removed from the operation of compulsory arbitration. Enough contentious issues remained, however, to keep the tribunal busy. Many of its awards were in

relation to union claims for increased pay and the like, claims which would not be submitted to arbitration in the States.

One of the major criticisms in the U.S. against arbitration, either voluntary or compulsory, of such "interest" conflicts is that arbitration would undermine effective and realistic collective bargaining. There would be a tendency to overpitch claims and to "pass the buck" for settlement to the arbitrators. There is no conclusive answer to this contention, for so much depends upon the traditions, mores, and general culture of the country whose industrial relations developments are under consideration.

In Britain, there has been recourse for years to various forms of *voluntary* arbitration, i.e., where *both* employers and unions agree to the decision being made by a third party. Neither employers nor unions have felt these arrangements to be a serious threat either to their rights or to effective collective bargaining. A case could also be made that compulsory arbitration actually encouraged the adoption of more voluntary arbitration as an integral part of various bargaining procedures, the parties in this case believing that if the arbitration process was to be extended in scope, then preferably it should remain voluntary.

This policy has long been encouraged by successive governments. Under the Orders of 1940 and 1951, the Minister of Labor could only refer disputes to compulsory arbitration if he was satisfied that all existing negotiating procedures established between the parties had been exhausted. If such procedures provided for some form of voluntary arbitration and an arbitration award had already been made, then the Minister could not, by law, send the dispute for compulsory arbitration. The statutorily created tribunals of 1940 and 1951 were never intended to serve as "appeal courts," ranked above arrangements supported jointly by the parties concerned. This is a further manifestation of general governmental policy for many years in regard to industrial relations: that every encouragement should be given to autonomous arrangements rather than that the State should impose its will on the disputing parties. A prerequisite of such a policy is obviously a fair maturity of behavior on the part of employers and unions alike.

Who Is to Use Compulsory Arbitration?

If compulsory arbitration is to be considered a service to those directly involved in disputes as well as to the public in a more general sense, rather than as an attempt by a government agency to impose peace on warring factions, the question arises as to who may refer disputes for settlement to arbitration. Should such rights be conferred, for instance, on an individual workman, on nonunion workmen, or on a breakaway union (a group of workers who have broken away from a parent union in an attempt to form a separate union), or should they be restricted to the representatives of organized labor, i.e., the trade unions who have helped to shape existing agreements? The last named limitation was in fact introduced in 1951. While it was possible to have an arbitration award made on a dispute arising from the payment of one workman, the privilege of reporting such a dispute to the Minister of Labor was afforded only to the representative trade union. Except for a certain category of disputes referred to in the introductory remarks, employers were also free to report disputes which involved their own workmen. These various arrangements were designed, in part, to encourage workpeople and employers to join their respective organizations, this being again a reflection of general governmental policy to stimulate the growth of voluntary collective bargaining.

But who, in the narrow sense should be affected by the awards of the tribunal? Patently, employers and workmen; but who is a workman? Under the 1951 Order, "workman" was defined sufficiently broadly to in-

clude such an august employee as the town clerk (a job which bears some relationship to that of city manager) of a large city as well as the humblest of general laborers.

Composition of the Arbitrating Body

A wise selection of arbitrators is crucial to the effective operation of compulsory arbitration legislation. The people chosen must command the respect and confidence of the employers and the trade unions. Although under both Orders such selection was the responsibility of the Minister of Labor, he was under an obligation to consult with the B.E.C. and the T.U.C. to determine who would be suitable and acceptable people to serve as arbitrators. The usual composition of the tribunals was as follows: three independents, i.e., people with no direct connection with industry but with a good record of public service; an employer representative "nominated" by the B.E.C.; and a worker representative "nominated" by the T.U.C., the latter two members having no connection with the dispute before them. Clearly the employer member had to be acceptable to the trade union appearing before the tribunal and vice versa. All five members had to be acceptable to both parties. The three independent members of the first tribunal in 1940 were a Justice of the High Court, a barrister experienced in industrial conciliation and a University Vice-Chancellor who had served for a number of years on wage-fixing bodies. This kind of pattern was preserved throughout the 19 years of the operation of compulsory arbitration.

Independence was a key concept in the formation and operation of the tribunals. It cannot be overstressed that, once established, the tribunals functioned independently of governmental control. In other words, they did not become an extended arm of the government's wages policy. The Minister of Labor could give the tribunals neither instructions nor advice as to how particular disputes should be settled. His function was to act as a check between the disputants and the "judges" to determine whether the dispute had been properly reported, whether a dispute was within the meaning of the Order, and whether the parties had properly utilized all the means of self government at their disposal for resolving the dispute.

Such independence, of course, does invite debate about how much consideration arbitrators should attach to general economic conditions, pronouncements by government spokesmen about the need for wage restraint, the dangers of inflation, and so on. There has been broad agreement, however, that arbitrators should judge claims largely on the merits of the localized circumstances in which they have their origin. That arbitrators have not been unmindful of the broader economic implications of their awards, however, has been demonstrated several times. An interesting example of this type of occurrence happened shortly before the demise of the Industrial Disputes Tribunal. The engineering unions had succeeded in having their claim for a 40-hour week (a reduction from 44 hours), referred to the tribunal. The arbitrators refused to make an award, partly on the grounds that they thought the employers and trade unions could still effectively negotiate on this claim and partly because they considered that it would be wrong for them at the end of their life span to make a legally binding award that might have significant repercussions in the rest of British industry.

Awards of the Arbitrating Body

While published summaries of the arguments advanced before the tribunals by the employers and trade unions are readily available together with the details of the actual awards, the reasons which have prompted these awards are not announced. While this silence has the merit of frustrating wranglings between employers and trade unions which would almost certainly ensue if reasons for awards were given, it also hampers the formal development of an arbi-

tration policy, if such a thing is considered desirable. It is possible, of course, to deduce certain arbitrating trends from year to year merely by a study of the awards themselves.

By and large there is agreement by both employers and trade unions that the nondisclosure of reasons for awards is a sensible practice, although some trade-union leaders have argued on occasion that reasons should be given and the right established for the aggrieved party to appeal to a higher tribunal created especially for this purpose. Such legalistic conceptions have not gained much support. There is, as yet, no established economic and social canon for arbitrators. Their reticence is, therefore, prudent.

Results and Implications of Compulsory Arbitration

Enforcement: There is general agreement that if compulsory arbitration entails some restriction on the right to strike, then enforcement becomes the most difficult problem. During World War II, there were 109 cases of prosecution of workers, involving 6,281 individuals, two cases involving prosecution of employers. Usually, strikers were only prosecuted when they defied their unions and when there was direct harm to the war effort. The total number of strikers found guilty during the war was even less: 2,042. The total number of working days lost through stoppages during four war years, 1941 through 1944, was 8,129,000. This compares with 8,530,000 days lost in the last four years of peace before 1939, i.e., 1935 through 1938. This comparison needs a number of qualifications, including reference to the fall in unemployment resulting from the war, the consequent rise in power and status of the unions, the necessary dilution of skills to meet wartime mass-production requirements, and the fact that not all stoppages under the 1940 Order were illegal.

There was certainly far less industrial strife in World War II than in World War I. It is perhaps impossible to evaluate how much credit the 1940 Order, which was more realistically drawn than the equivalent legislation of World War I, should take for this improvement. There was considerably more national unity during 1939–45 than 1914–18, the social values of society were quite different, and the profiteering evils of World War I were not repeated.

The essential reasoning behind the 1940 Order was that disputes might be avoided if a waiting period could be enforced between the time when workers decided to strike or an employer to lockout and the time when they were legally entitled to do so. How sound is such reasoning? Unfortunately, as yet the answer lies, and may continue to lie, in the realm of opinion and not established fact. One interesting factual sidelight is that of the 4,510 cases reported to the Minister during the lifetime of the 1940 Order, 2,197 were settled voluntarily, i.e., they were settled without reference to compulsory arbitration.

It might be asked whether it would be feasible, where strikes are called in defiance of the requirements of compulsory arbitration and are damaging to the national interest, to levy fines or to enforce damages against union funds. Such proposals were not even seriously considered during World War II. The mere prosecution of strikers can quickly establish martyrs and consolidate a resistance movement around the rallying cry of "victimization." Legislation designed to weaken trade-union funds would have caused serious damage to worker morale and had unfortunate political repercussions. The funds of trade unions in Britain enjoy considerable immunity from the operations of the law and such immunity is likely to remain for the foreseeable future. Although the British public have become rather more irritable with trade-union behavior in recent years (this is one reason for the declining support for the Labor Party), it is highly doubtful whether it would permit union funds to be made vulnerable in the manner

suggested. I think it is fair to say, for reasons which I have not space to elaborate, that the trade unions in Britain enjoy a wider measure of public acceptance than they do in the U. S.

Compulsory Arbitration and Collective Bargaining: Compulsory arbitration has been removed from the industrial relations scene in Britain largely because employers felt that the compulsion was exerted in one direction only, theirs. They did not attempt to make a case that arbitration *per se* was damaging to effective collective bargaining. With certain reservations, there has been general support in Britain for the idea that arbitration should serve as a peaceful method of settling disputes and not as some form of automatic third-rate substitute for collective bargaining. As mentioned before, all statutorily created forms of arbitration services have provided that before they could be used, employers and unions had to establish that all existing negotiating procedures agreed between them had been thoroughly, realistically, but unsuccessfully exploited. Having said this, it is only fair to point out that few disputes arising from industry-wide negotiations were referred to compulsory arbitration after 1951. While major awards made by the Industrial Disputes Tribunal have been relatively few in number, indicating that where large-scale issues are involved employers and trade unions prefer the two-party collective bargaining method, it is reasonable to infer that the Order did prevent a number of strikes, for the tribunal would not arbitrate under duress, i.e., would not make an award if a strike was already in progress. More positively, both Orders promoted many settlements which in their cumulative effect must have been more beneficial to the general industrial-relations atmosphere than resorting to trials of strength would have been. It now remains to be seen whether the trade-union opposition to the removal of compulsory arbitration with the abolition of the 1951 Order will be justified. They have said that in the future they may have to resort more readily to the strike weapon, since they can no longer compel the obstinate employer to go to arbitration. On the other hand, with compulsion removed, such an employer may be more willing to make a joint approach with the trade union to voluntary arbitration.

Compulsory Arbitration and Strikes Against the National Interest

As indicated above, compulsory arbitration had only limited success in preventing strikes during 1940–51, and from 1951 onwards, few major disputes were settled by this process.

One further power, however, remains to the Minister of Labor. If a major dispute threatens or is already in progress, he may set up a Court of Inquiry. This is an independent fact-finding body having certain legal powers, e.g., it can summon witnesses to give evidence. The Court listens to the claims and counter-claims of the combatant employers and unions and makes recommendations which it is hoped will form the basis of a settlement. Such recommendations are not backed by any legal sanction, but they are almost invariably accepted by the parties to the dispute. This happens for a variety of reasons: The Court has great moral authority; sparing use is made of the Court so as not to weaken this authority; the Court marshalls evidence which is presented to Parliament and to the public; public opinion begins to harden, bringing pressure to bear on the more stubborn of the two parties. It should be remembered, too, that in a country the size of Great Britain, which is so dependent on exports, the effects of an industrywide strike are more readily apparent than would be in the case of a similar strike in the U. S. Lines of export automobiles at the docks waiting to be shipped to pay for barges of food which cannot be unloaded and which have to be tipped, rotting, into the Thames, are subjects for conversa-

tion in pub and home. The results of a national strike in engineering, Britain's single biggest contributor to export earnings, are very quickly felt, and the intervention of the Minister of Labor prompted.

Although the Minister has no power to order strikers back to work and cannot seek an injunction from the courts to do so, the strike is invariably called off when he has appointed the members of the Court of Inquiry. While other factors affect the situation, including the nicety of timing by the Minister, this example does illustrate the respect in Britain for moral suasion and the sensitivity of response by employers and unions to public opinion.

Conclusions

Compulsory arbitration, introduced in Great Britain in 1940 as an emergency measure, was continued in a modified form from 1951 to 1959 on an experimental basis. The continuance of the experiment proved unacceptable to employers and, therefore, was abandoned. It seems clear that, in wartime or peacetime, compulsory arbitration in Britain will be effective only to the degree that it is voluntarily accepted by the parties involved.

Acceptance of compulsory arbitration in wartime Britain was obviously helped by the claims of patriotism. But even these claims were not sufficient to achieve full acceptance (as the figures for prosecutions of strikers noted above indicate). If the rules which the unions themselves have helped to formulate are broken by groups of their members, then thorny problems of enforcement arise. During the war, the British did not consider it to be practical or desirable to send workers to prison for contempt of court following their refusal to pay fines imposed on them for having taken part in illegal strikes. In fact, strikers were prosecuted in only a minority of possible cases. A weakness inherent in the concept of compulsory arbitration, where some restriction on the right to strike is entailed, is the problem of enforcement in the event of large-scale defiance by workers. If enforcement is pursued half-heartedly, then the related problem of maintaining respect for the law is engendered. Where such defiance has been shown, the British have trusted to good sense to prevail rather than imposing further punitive measures on the conduct of industrial relations.

After six years of peace (1945–51), it was considered undesirable for a striker to be liable to prosecution and unwise to continue with legislation which was becoming increasingly difficult to enforce. Therefore, the rules of compulsory arbitration were changed to remove penal sanctions and the new rules remained operative until 1959, when employer dissatisfaction led to their repeal.

What then is to be done about strikes that are self-evidently damaging to the national interest? Britain did not find that compulsory arbitration provides the answer to this question. Where a major strike has threatened or has actually been in progress, the British Government, after first trying mediation, has generally established a Court of Inquiry, whose findings are made public. A settlement is almost invariably achieved this way, an indication of the heavy reliance the British place on the pressure which can be exerted by public opinion.

Not since the General Strike in 1926 has it been necessary to examine seriously in Britain some of the methods and proposals which are applied or discussed in America for the resolution of major disputes. Here I am referring to methods of intervention such as plant seizure by the government, the issue of injunctions, the Massachusetts "choice of procedures" approach, and so on. Such procedures have not been an issue of public policy in Britain in recent years. My only reservation to this statement is that in the immediate postwar period, troops were used on occasion when the government, faced with dock strikes, felt impelled in the public interest to have perishable foodstuffs unloaded. While it is outside the scope of this

article to examine the implications of the various American procedures, actual or proposed, it might fairly be asked of me whether I consider the British method of Court of Inquiry to be a feasible arrangement for settling disputes in the U. S. which "imperil the national health or safety." My answer would be no, at least for the time being.

While I favor the independent inquiry approach when it relies on moral rather than legal sanctions, it is clear that the boards of inquiry provided for under Taft-Hartley and the Railway Labor Act have not been a conspicuous success.

However, I suspect that the fundamental reason for the failures rests in the fact that employers and unions have not yet learned to live with one another as harmoniously as their counterparts in Britain. In support of this contention, one can point to the fact that in the U. S., there is more legal regulation of industrial relations than in any other industrialized country in the world. Much of this legislation could be scrapped, I think, if a more widespread sense of industrial statesmanship, entailing compromise and tolerance among employer and labor leaders, could be developed. This kind of statesmanship requires a maturing process. And with increased maturity might come a respect for and observance of the findings of a group of impartial men, appointed to promote the settlement of a major dispute. This method, or slight variations of it and not compulsory arbitration, injunction, plant seizure and the like, remains the most effective method of settling emergency industrial disputes in Great Britain. Given the present industrial-relations climate in America, it would seem that the more "legalistic" procedures will have to remain in operation.

On the whole, it is patience which makes the final difference between those who succeed or fail in all things. All the greatest people have it in an infinite degree, and among the less, the patient weak ones always conquer the impatient strong.

Ruskin

The Growing Concern Over Business Responsibility

WILLIAM C. FREDERICK

In the new era of business power, the old philosophy of business responsibility has been outdated. This article suggests a new and more adequate standard to follow in judging your responsibility, as a businessman, to society.

The television quiz show scandal, aired last autumn in Congressional hearings, has highlighted an issue that has been of increasing concern to many people—the public responsibilities of private businessmen. Concern about business power is not new, but the past decade has seen a growing consciousness of the problems that business power can create in a democratic society.

It is the contention of this paper that the heightened interest in the problem of business responsibility can be explained in terms of two developments of the twentieth century. One of these developments is intellectual, the other is institutional in character—and both of them are related to the collapse of *laissez faire* as a philosophy and as an economic order.

The Relevance of *Laissez Faire*

The disintegration of the world economy, starting early in the present century, signaled the beginning of the end for the *laissez-faire* philosophy and all its supporting institutions. The trend, accelerated by the First World War and the subsequent monetary panics of the 1920's, culminated in the early 1930's in what Karl Polanyi has characterized as "The Great Transformation." Free economy was transformed into regulated economy in all of the advanced nations that stood in the capitalist tradition, including Soviet Russia, where the 5-year plans were initiated; Germany, where National Socialism was in the ascendant; Italy, which was in the throes of corporate Fascism; and the United States, where the New Deal was the symbol of institutional transformation on a grand scale. These and other domestic economies, seeking to protect themselves from the ravages of a self-regulating market mechanism, were transformed to an economy in which centralized state planning and regulations were increasingly the rule rather than the exception.[1]

At the same time, it became more and more obvious that the world of business itself was the scene of growing economic power. Moreover, the growth of the large-scale corporation, with its tendency to divorce legal ownership from actual control of operations and with its technique of feeding upon itself for growth capital, freed the giants of business from the checks formerly put upon them by stockholders and capital investors. In addition, business had combined two forces to dilute what could be considered "consumer sovereignty:" a refined and sophisticated advertising program and what amounted to programming control of one of the nation's mass media of communication, thereby making possible the massive tailoring of consumer tastes to the standards of mediocrity that have become so common in our times.

[1] Karl Polanyi, *The Great Transformation* (New York: Rinehart and Company, 1944).

All of this institutional transformation was remarkable enough. Even more remarkable (though far less spectacular) was the intellectual revolution that accompanied the institutional change of the old order. It was to be expected that the maxims that had guided economic thinking for over a century would undergo change as the institutions themselves were transformed, and as early as 1933, Robinson and Chamberlin had written economic treatises discussing the impact of the large-scale corporation on traditional forms of competition.[2] Three years later Keynes published *The General Theory of Employment, Interest and Money.*

But the real revolution in ideas came from without—primarily from the social sciences. Psychology challenged the concept of a rational "economic man" who always pursued pleasures and avoided pains. Sociology questioned the individualistic "Robinson Crusoe" theory of behavior which had been an article of faith with economists for years. And comparative anthropology brought into serious question the belief in natural rights and natural order—a belief basic to the philosophy of *laissez faire.*

In a few words, the philosophy of *laissez faire* had collapsed as thoroughly as had its supporting institutional framework. All of the major foundation stones were disintegrating. Gone, or seriously weakened, was the invisible hand of free competition which was to guide selfish interests into socially-useful channels. Displaced from the center of the stage were the old forms of business organization—the proprietorship and the partnership—through which competition was to work. Gone was the theory of behavior which posited a free and rational individual capable of promoting his own interests if only allowed to do so by a meddlesome government. Gone was the theory of social institutions which found at their core a rational desire of man to solve his problems. Gone was the theory of a harmony of interests which was to be the automatic outcome of the self-seeking interests of a society of rational men checked in their selfishness by the invisible hand of competition. A type of civilization and a way of thinking were truly "gone with the wind."

The collapse of the *laissez-faire* philosophy created a philosophical vacuum. It is this vacuum that businessmen and others interested in the issue of business responsibility have been trying to fill since the end of World War II. Under the *laissez-faire* philosophy private interests were supposed to be channeled into publicly useful pursuits, but now such institutions as had been responsible had fallen into disuse. Under the *laissez-faire* philosophy, there had been a social theory by which private interests could be harmonized with the interests of society at large. This meant that there was no need to be concerned deliberately with the social responsibility of private businessmen; it would be produced automatically. But now there was no such theory. Quite plainly, the older rubrics no longer furnished an adequate intellectual system for explaining the social consequences of business activities. Hence, the collapse of *laissez faire* posed a giant intellectual conundrum for social theorists: How could a society with democratic traditions and democratic aspirations rationalize the growing amounts of power accruing to businessmen? And how could that power be channelled into socially-useful functions without driving the populace into some Orwellian nightmare of *1984* proportions?

Several events conspired to cloak the true nature of the crisis until after the Second World War. It is true that a few questioning voices were raised during the 1930's and the 1940's—most notably those of Adolf A. Berle and Gardiner C. Means in their monumental study, *The Modern Corporation and Private*

[2] Edward Chamberlin, *The Theory of Monopolistic Competition* (Cambridge: Harvard University Press, 1933); Joan Robinson, *The Economics of Imperfect Competition* (New York: Macmillan, 1933).

Property[3] and James Burnham in his analysis, *The Managerial Revolution*.[4] But preoccupation with the Great Depression and with the impending World War II served to postpone a consideration of the major problems of business power that had developed out of the broad-scale institutional changes in the 1930's.

However, with the resumption of peacetime production, and after it became evident that the American economy would not be subjected immediately to another large-scale depression, and particularly after studies which revealed the very great concentration of economic power that had occurred during the Second World War, all of the same worrisome questions were asked once again. Since 1950, as a result, five major currents of thought about business responsibility in American society have developed. Each of these currents attempts to grapple with the problems of power in a complex society and with the resultant issue of business responsibility to the society at large.

Management as Trustee

The first of these currents of thought, and one that has gained increasing favor, is the idea that corporate managers should voluntarily act as trustees of the public interest.[5] They should police themselves and their use of the tremendous amounts of power they possess. The keynote of this concept is the deliberate and voluntary assumption of public responsibility by corporate managers, even though at times such a trusteeship might cause a managerial group to forego immediate profits for the sake of the public good. Management, according to this concept, has a multiplicity of obligations—to the stockholders, to the employees, and to the public at large. This viewpoint, therefore, appeals to the conscience of individual managers to wield their power in a publicly responsible manner. One student of the problem has even called for the development of the "conscience of the corporation" to protect the public against possible abuses of corporate power.

The Relevance of Christian Ethics

Easily the most appealing and the most emotional of these five viewpoints is the notion of relating Christian ethical principles of conduct to the problems of business enterprise.[7] The basic idea seems to be that the businessman needs to think of himself as something more than a simple money-grubber. He needs to have a nobility of purpose that overarches his corporate activities and day-to-day duties. He needs "skyhooks" to orient him toward the nobler ideals of Christian ethical conduct so that he might become a practicing Christian businessman on the job. One spokesman for this viewpoint even argues the direct applicability of such Christian doctrines as the idea of original sin, forgiveness, creation, and the general concept of God to the problems of business. Christian ideals and doctrines are said, therefore, to furnish the Christian businessman with a framework of ethics by which he can approach and grapple with problems of finance, personnel, production, and general decision making.[8]

Balance of Power

One of the most intriguing ideas to reappear in the postwar period is the notion that the answer to concentrated business power is more power.[9] The central theme of this argument is that business power is here to

[3] Adolf A. Berle, Jr., and Gardiner C. Means, *The Modern Corporation and Private Property* (New York: Macmillan, 1932).

[4] James Burnham, *The Managerial Revolution* (New York: John Day, 1941).

[5] Frank W. Abrams, "Management's Responsibilities in a Complex World," *Harvard Business Review*, May, 1951.

[6] Adolf A. Berle, Jr., *The Twentieth Century Capitalist Revolution* (New York: Harcourt Brace, 1954).

[7] For representative viewpoints see J. C. Bennett, *Christian Values and Economic Life* (New York: Harper and Brothers, 1954); O. A. Ohmann, "Skyhooks," *Harvard Business Review*, May–June, 1955; and Harold L. Johnson, "Can the Businessman Apply Christianity?", *Harvard Business Review*, September–October, 1957.

[8] Johnson (See note 7).

[9] John K. Galbraith, *American Capitalism: The Concept of Countervailing Power* (Boston: Houghton Mifflin, 1952, 1956).

stay and that the answer to this problem is to build up countervailing power in the hands of the other major groups in the society so that a balance of power is struck between the contending members of society. Only by actively participating in the race for power can the various sectors of society protect themselves from the overweening power held by others. Government, according to this viewpoint, should play a major role in establishing a balance of power between the major functional segments of the economy, even if it means taking the side of one group against all the others while a sufficient amount of countervailing power is being developed. Thus, the balance of power doctrine handles the problem of business responsibility by permitting all parties, including the business interests, to look out for their own economic and social interests. The public welfare is presumed to be the outcome of the balanced sum of interests represented in the power struggle. This relieves businessmen of deliberately and consciously promoting public responsibility, often in contradiction to their own private interests.

The Viewers with Alarm

Perhaps the strongest of the currents that have attempted to fill the philosophical vacuum left by the collapse of *laissez faire* consists of the ideas of the group that "views with alarm."[10] Often these spokesmen see the problem of business power as only one facet of a larger process, namely, the drift of the total society toward monolithic and totalitarian control of the human mind and spirit. Huxley, Orwell, Riesman, Whyte, and Mills—all basically humanistic in their philosophical predilections—are dismayed by the press of technology and organization upon the traditions of a free society. They express grave doubts about concentrating so much power in the hands of so few bureaucrats, whether of the industrial, the governmental, or the military type. The members of this group have no clear-cut answer to the problem of concentrated power, counseling a resistance of the spirit against the ravages of organization and mass technology. Business responsibility, they seem to say, will be achieved only when there is a general recognition by businessmen and others of the perils to the individual personality that accompany great aggregations of power.

Capitalist Ethic Reformulated

The fifth major current is actually composed of many smaller rivulets of thought, all of them related to an attempt to reformulate and restate the capitalist ethic in terms that will be acceptable in the changed institutional situation that now confronts those of us living under the capitalist tradition. Perhaps the most notable attempt to reformulate the capitalist ethic can be found in *The Capitalist Manifesto,* by Louis O. Kelso and Mortimer J. Adler.[11] This manifesto argues that the capitalist revolution will not be fully realized until some of the basic capitalist principles—ownership, for example—have been extended to embrace ever larger numbers of citizens. As ownership is more widely diffused, so will the citizen's stake in the prevailing system increase. As a result, his interest and loyalty to the modified capitalist system will increase. Thus, a higher degree of responsibility on the part of capitalist-owners will be achieved by modifying and extending one of the basic capitalist institutions. Clarence B. Randall, formerly chairman of the Inland Steel Company, has also tried to restate a more realistic ethic for the capitalist system in his book, *A Creed for Free Enterprise.*[12]

[10] Representatives of this viewpoint are George Orwell, *1984* (New York: Harcourt, Brace and Company, 1949); David Riesman *et al.*, *The Lonely Crowd* (New Haven: Yale University Press, 1950); William H. Whyte, Jr., *The Organization Man* (New York: Simon and Schuster, Inc., 1956); and C. Wright Mills, *The Power Elite* (New York: Oxford University Press, 1956).

[11] Louis O. Kelso and Mortimer J. Adler, *The Capitalist Manifesto* (New York: Random House, 1958).

[12] Clarence B. Randall, *A Creed for Free Enterprise.* (Boston: Little, Brown and Company, 1952).

A Critique

There is a surprising shortcominng shared by these five schools of thought: not one of them offers a clear-cut, substantive meaning of the social responsibilities of businessmen. That is, none of them explains in unequivocal terms what would constitute socially responsible business behavior. The public trustee theory and the Christian theory have been heavily influenced by the remnants of the *laissez-faire* philosophy in which "the greatest good of the greatest number" seems to have been a major criterion of social responsibility, although we are still left in some doubt as to the precise nature of the "good" to which the formula refers. The balance of power theory generally suffers from the same shortcoming, although in the case of John Kenneth Galbraith's version of countervailing power it is rather obvious that total over-all economic production constitutes the criterion of value, especially as revealed later in *The Affluent Society*.[13] The basic value assumptions of the "viewers with alarm" are those of individualism and humanism; therefore, socially responsible business behavior presumably would protect the integrity of the individual and humanist qualities generally. But it does seem amazing that throughout most of these writings there appears no precise formulation or description of behavior that clearly bears the label of social responsibility.

The real explanation, of course, is to be found in the precise nature of the intellectual vacuum created when the *laissez-faire* system collapsed. For that vacuum, more than anything else, is a vacuum of values. It is our value systems that have been most sorely bruised in the transformation to the world of large-scale organization and technology. Older value systems have been rendered useless by the advance of knowledge and by vast institutional transformation. And new value systems have not yet had time to emerge. We stand too close to the older systems and to the dust that still rises from the ruins of the fallen order. And as the five major schools of thought seem to demonstrate, the temptation to dart back into the murky ruins of the old order and to snatch at the weakened timbers for use in constructing a new philosophical framework is still great.

Moreover, the public trustee theory and the Christian theory are startlingly naive in some respects. They seem to ignore some of the basic and fundamental realities of historical development and of the contemporary institutional setting in which business enterprise operates. To the extent that they are based on a theory of history at all, that theory is an idealistic or a romantic one. Such a historical theory ignores the essentially materialist and self-seeking basis of business enterprise as it emerged in Western culture. Further, both the trustee and the Christian theories seem to ignore the force of historical tradition and custom in determining the basic value elements of contemporary business institutions and the force that these traditions still exert upon the behavior of businessmen caught up within such a historically determined system. Both theories seem to imply, for example, that private gain can be simply pushed to one side by the force of will of public-spirited businessmen or of those who have been inspired by Christian ethics.

In addition, the theory of behavior that underlies both of these positions on business responsibility ignores some of the basic and most significant findings made by social scientists in the past fifty years. Little or no use is made, for example, of the concept of the social role, which explains the behavior of any given individual in terms of a pattern of interrelated actions drawn from a variety of sources within the contemporary institutional setting. Such a social role defines for an individual a pattern of behavior to which he is expected to conform in order

[13] John K. Galbraith, *The Affluent Society* (Boston: Houghton Mifflin, 1958).

to carry out his socially approved functions within the society. The businessman's role is defined largely, though not exclusively, in terms of private gain and private profit. To ignore this important fact, or to assume that the businessman himself can ignore it simply by force of will inspired by Christian ideals or by public spiritedness is preposterously naive.

Therefore, we find that the businessman, by virtue of historical traditions and contemporary institutional forces, is in a sense "locked into" a going system of values and ethics that largely determines the actions he will take. There is no question that the system itself is subject to change over a period of years. Neither is there any doubt that the force of an individual personality can wield a great influence over the manner in which a person acts out his socially defined role. But there also seems to be little question that at any given time individuals who are active within the system of social roles and institutions are subject in large measure to its prevailing characteristics. This means that businessmen *must* be concerned primarily with private gain and profits, for they are a prime value within the presently existing system of business enterprise.[14]

The balance of power theory, on the other hand, is a grown-up version of the automatic institutional forces that allegedly worked for the social good under the *laissez-faire* order. The argument is basically the same: When countervailing power is brought to bear against the holders of original power, such privately wielded power will be deflected into channels that are not so harmful to the interests of society as would otherwise be true in the absence of such a power struggle. Under the *laissez-faire* order, competition between self-seeking business firms was said to have produced the same effects. Countervailing power in the Twentieth Century substitutes for the free competition of the Nineteenth Century. As Galbraith himself has been careful to point out, there are certain institutional situations, particularly inflation, in which the whole balance of power system breaks down and does not in fact channel private power into socially desirable uses. Moreover, in *The Affluent Society,* Galbraith seems to be saying that the entire institutional order, including the balance of power system is outmoded and unserviceable with respect to the utilization of society's resources for socially intelligent ends.

Some of the most powerful statements on business responsibility have been made by the "viewers with alarm," who, like Galbraith, at least are cognizant of some of the realities of the contemporary scene. They are aware, for instance, that power is now drawn up in different configurations and different proportions than was true of the older order; and they sense that these changed dimensions of power have shifted the nature of the problems. But since the alarmists are basically individualistic and humanistic in their predilections and since both individualism and humanism are products of an age before the fantastic aggregations of power that we know today, there is very little the alarmists can do except object to what is going on and to what power accumulations are presumably doing to individuals and to human values generally. For them, there is no way out save by some brand of passive resistance to the organizational society and its many bureaucratic institutions. It is characteristic of this group of thinkers that they have little or nothing to offer in the way of an institutional system that will lead us out of our present difficulties with respect to promoting the social responsibilities of private businessmen.

The Basis of an Adequate Theory

An adequate theory of business responsibility must meet several requirements. First, its criterion of value should be drawn from

[14] This seems to be the major point stressed by Theodore Levitt in "The Dangers of Social Responsibility," *Harvard Business Review,* September–October, 1958.

our increasing awareness of the requirements of socially effective economic production and distribution, and particularly the necessities of economic growth and development on a broad social scale. Some such value criterion has been a part of American thinking since the Great Depression of the 1930's, and it was reinforced by the great emphasis that the Second World War placed upon the value of high production and the efficient allocation and distribution of economic resources. In the current race with the Soviet Union to dominate the world economic scene, we see once again that economic production and distribution constitute a major criterion of value. Further, such a value assumption underlies the Employment Act of 1946. Also, such an assumption has caused the nation's two major political parties to pledge themselves to use all of the resources of government at their command to offset the fluctuations of the business cycle.

All of this suggests strongly that when we invoke the phrase "the social responsibilities of the businessman," we mean that businessmen should oversee the operation of an economic system that fulfills the expectations of the public. And this means in turn that the economy's means of production should be employed in such a way that production and distribution should enhance total socio-economic welfare. Social responsibility in the final analysis implies a public posture toward society's economic and human resources and a willingness to see that those resources are utilized for broad social ends and not simply for the narrowly circumscribed interests of private persons and firms. The television quiz show scandal is a case in point.

The second requirement of an adequate theory of business responsibility is that it be based upon the new concepts of management and administration that are now emerging. There is an increasing awareness of the usefulness of scientific methodology in defining and solving problems within the management environment. The "Great Man" theory of management is being replaced with a concept of the manager as coordinator and planner, as a team member whose main play consists of making significant links between relevant pieces of information. This means that managers need to reconstruct their self-images and to de-emphasize the role that status and authority play in the management function. And finally, the study of human relations is convincing managers that careful treatment must be accorded employees if they are to be fully effective in the work situation and if their jobs are to form a part of the "good life." Any theory of business responsibility that ignores these recent developments in management science would be seriously deficient.

Third, an adequate theory of business responsibility will recognize that the present business system is an outgrowth of history and past cultural traditions. It will recognize that what we are today is, to a very large extent, a function of what we were yesterday. In more specific terms, this means that there is not likely to be any escape from the very powerful motive of private gain and profit which is often at variance with social interest. Rather than denying the importance of this force or wishing it away in an idealistic fashion or assuming that businessmen can or will ignore it as they make decisions, the new theory of business responsibility will attempt to find institutional means for hedging about this motive and for directing it into socially useful channels. This, of course, is the hope of Galbraith in his theory of countervailing power. It is also a hope expressed by Berle in *The Twentieth Century Capitalist Revolution* in which he speaks of the need to develop "the conscience of the corporation."

The fourth requirement of a theory of business reponsibility is that it recognize that the behavior of individual businessmen is a function of the social role they play in business and in society. This means two things: (a) that the individual businessman, however

noble may be his intentions, is often unable to influence significantly the total business configuration within which he works; and (b) that many times the individual businessman will be motivated to take action or make decisions that are not at all consistent with the ideals of social responsibility that he may hold in the abstract. Both forms of behavior are understandable when we realize that the businessman does not operate in a cultural vacuum but within a social role whose total pattern is fairly well defined for him by the mores of his society.

Fifth, there should also be a recognition that socially responsible business behavior is not to be produced automatically but is rather to result from deliberate and conscious efforts of those institutional functionaries who have been given this task by society. There are no magic formulas and no automatic mechanisms which by themselves will guarantee the results that the public desires. Conscience alone, whether of public trustee or of Christian businessman, is not enough. A balance of power is likewise insufficient. Nor is courageous action by public servants enough. The task requires a constant tinkering with the institutional mechanisms of society, employing more and more of the fruits of scientific methodology and the scientific attitude. The job, though difficult, should become easier as social scientists increase their knowledge of human behavior and human institutions. It is true that we cannot totally escape the impact of our cultural heritage, but we are slowly accumulating a storehouse of knowledge about ourselves and about businessmen that should enable us to resolve some of the problems and issues of business responsibility.

I congratulate poor young men upon being born to that ancient and honorable degree which renders it necessary that they should devote themselves to hard work.

Andrew Carnegie

Methods for Forecasting Consumer Demand for Specific Products

FRANCIS W. DRESCH

A discussion of two methods by which consumer demand for a full line of many products can be forecasted quickly and economically.

This discussion of two methods by which consumer demand for specific products can be forecast is intended to illustrate the objectives of and some of the special problems involved in making the short-run forecasts typically required for inventory control or production scheduling.

Short-range forecasting is of such widespread importance that it may seem unnecessary to cite practical examples of its use. However, by examining some of the practical requirements for this type of forecast, it is possible to make several generalizations about the circumstances under which such requirements usually arise. These generalizations, in turn, suggest various practical considerations of extreme importance in the design of forecasting techniques.

Let us first list a few applications of short-run forecasting.

1. Short-run weather forecasts
2. Crop forecasts
3. Election forecasts
4. Price forecasts for commodity and security speculation
5. Regional demand forecasts for distribution planning
6. Demand forecasts for inventory control and production scheduling
7. Short-run economic forecasts.

Many other applications will suggest themselves, but this list should be sufficiently representative.

All but two of the applications involve a need to forecast continuously on an hourly, daily, weekly, or monthly basis. These applications also require simultaneous treatment of a mass of individual time series—for example, demands for a large number of production or inventory line items, weather forecasts for many areas, etc. The two exceptional items on the list are crop and election forecasts, but even in these cases the requirements arise periodically and usually involve prediction of a number of related and more or less concurrent events. Different crops, regional differences, or different political contests transform even these exceptional cases into many-faceted problems; a huge mass of data must be analyzed to provide a great number of individual forecasts.

The first generalization is that those practical applications of short-run forecasting which involve the bulk of the forecasts involve simultaneous treatment of a mass of data to produce a multitude of predictions on a periodic or continuing basis. One inference that may be drawn from this generalization is that the techniques for such forecasting must be reasonably cheap and mechanizable. The payout from a particular technique lies not in its infallibility but in its success on the average when applied *en masse* and over a reasonably long time span.

A second generalization is that in practical high-volume cases, the concern is with con-

tinuous variables, not yes or no events. Moreover, the payout comes from good average accuracy rather than great precision.

A third generalization is that such short-run forecasting must be done quickly: the decisions affected by forecasts of this type must be made on time and frequently on a backbreaking schedule. Special time-consuming studies are not in order. In general, then, the practical problem is to devise schemes for forecasting time series quickly and cheaply while handling volumes that demand mechanization.

The traditional treatment of time series in economic forecasting involves an attempt to decompose the individual series into components: long-run secular trend; true cycles such as seasonal, weekly, or daily patterns; less-regular up and down movements related to business cycles for a particular industry or the whole economy; random variations treated as due to chance; and erratic fluctuations of a special type predictable only if they can be anticipated in time from precursor events or known causes, such as effects of changes in the Federal Reserve rediscount rate.

In practice, the erratic fluctuations can rarely be forecast and can never be handled mechanically. Moreover, the random variations, however troublesome they may be, are also outside the scope of the forecaster's job, except perhaps for observation of their statistical distributions in order to estimate probable error of forecasts. The real job is to predict the secular trend and the true or approximate cycles.

One hopeless quest that plagues the forecaster is the insistence of his employers on efforts to discover indicators or barometers—series that correlate with the series studied but which precede or lead it. Since most of the important series in operations control follow very closely on the heels of their first causes, this search is usually futile. In such forecasting problems, therefore, there is little useful information readily available outside the history of the individual series themselves or the parallel histories of their immediate cousins. Where multiple correlations are the favorite tool of the long-range forecaster, serial or autocorrelations tend to be the tools of the short-term forecaster concerned with control. His series supply in themselves the best information as to their future behavior. Other data might often be relevant, but it is usually available too late or is too qualitative and subjective to be used mechanically for modifying predictions with the necessary speed. Aside from some use of human intervention in machine-forecasting systems to modify mechanical forecasts in response to spot situations, most routines depend only on historical data relating directly to the series being forecast.

To illustrate these general characteristics of short-run forecasts in production scheduling, let us consider two case studies for which two different techniques were tried. Either technique might have been tried in either case, although the situations were somewhat different. The one used in each case seemed slightly preferable for the circumstances to which it was adapted. This choice the reader may evaluate for himself after reading the discussion of the techniques, the advantages of each, and the circumstances in the separate cases.

In order to discuss these two cases with greater freedom than otherwise permissible, I will not identify the companies which provided these forecasting problems. Both arose in connection with production-scheduling studies. In both cases, forecasts of demand were required on a monthly basis. One case study was concerned with the manufacture of dinnerware involving a line of style items subject to a highly seasonal demand and to a characteristic growth and ultimate decay typical of the demand for each dinnerware pattern. The other study was concerned with the manufacture of a more stable line of chemical products with a less-pronounced seasonal fluctuation in demand. In both

cases, several thousand distinct line items were involved. In the case of the dinnerware manufacturer, the various items from any dinnerware pattern tended to enjoy a predictable share of the total demand for that pattern. In the case of the chemical manufacturer, the line items were less easily grouped.

Let us now consider these cases in detail, starting with the problem of the dinnerware manufacturer. Consider first the problem of forecasting total pattern sales without differentiation into individual line items. The pattern has an annual total sale which must be forecast entirely on the basis of history to date, pre-issue buyer acceptance tests, or position in the typical life cycle of a normally behaved demand growth pattern. General business conditions have an effect on the total annual sales of the company, but these effects appeared to be independent of pattern. The problem in determining monthly sales for the whole pattern resolved itself into determining the appropriate seasonal factor and the annual forecast. Attempts to find different seasonal factors for different patterns failed to produce significant differences, and the use of a common seasonal factor for all patterns seemed adequate, if not necessary.

This seasonal factor was computed in a more or less traditional manner. Three years of history were considered. The seasonal factor for January was obtained, for example, by dividing the total orders for the three Januaries by the total orders for the three-year period. In the case of a pronounced trend, this procedure should be refined to center the three-year history about the center of the three Januaries, but this refinement appeared unnecessary in the case considered. As sales for the year developed, cumulative orders to date for each pattern were compared with the corresponding forecasts—as based on projected total demands for the pattern for the year and the seasonal adjustment factor. If cumulative orders differed from forecasts in excess of assigned tolerances, the forecast of *projected annual demand* was adjusted to provide better agreement with observed cumulative demand—otherwise forecasts were continued without adjustment. It was found undesirable to adjust the forecast of annual sales all the way to the position indicated by demand to date, since such an adjustment proved to be over-compensatory in most cases. To avoid excessively frequent adjustments, it was found (empirically) that adjustments of one-half the amount indicated by cumulative demand appeared to be appropriate. The seasonal factors were recomputed annually.

Once the pattern sales had been forecast by month, the demands for individual line items were obtained by application of item popularity ratios. These merely reflected the share of total pattern sales enjoyed by the particular item over the past three years.

These were the essentials of the forecast technique employed. In practice, certain refinements were added, and other refinements might prove desirable for other applications. In the dinnerware case, adjustments were required for special events such as planned promotions, and these were derived from special estimates. General business indicators, such as real disposable income, were found to correlate with total demand but with no evidence of pattern differences. Adjustments for these were obtained and applied on a percentage basis to all patterns in such a way that total demand, on summation over pattern, would agree with the best forecast of total orders. Special treatment was required for new patterns with less than three years of history. On strictly new patterns, pretesting and expert opinion were used to establish initial forecasts. As initial success or failure of a new pattern became apparent, comparison with the early histories of other patterns was employed to improve the preliminary estimates. Similarly, item

popularity factors were taken directly from those of other patterns with similar character or similar behavior.

Other refinements were investigated but discarded because of limitations on available computing capacity. These included a monthly updating of seasonal factors and item popularity ratios.

This system is still running as an integral part of a successful production scheduling system after three years.

The case of the chemical company was somewhat less traditional, since the individual items did not have a natural grouping as given by the dinnerware patterns. Also, seasonality, although less marked, differed considerably from item to item.

The approach followed here was more mechanical. To explain it, let us start with a numerical example. Since no examples are available from the chemical forecasts, the technique has been applied to a series on U. S. population. For reasons indicated below, this example is not one for which the technique is very suitable, but it will serve to illustrate the process and to point up some of the difficulties. Three different relations were tried, as exhibited in Table I, all of the form

$$P(t+1) = K_0\,P(t) + K_1\,P(t-1) + K_2\,P(t-2) + K_3$$

where:

$P(t+1)$ = Period forecast

$P(t)$ = Actual data for the current period, immediately preceding the period to be forecast

$P(t-1)$ = Actual data for the period preceding the period (t)

$P(t-2)$ = Actual data for the second period preceding the period (t)

K's = Least squares regression coefficients

In the first, K_1 and K_2 were set equal to zero, and a least-squares fit obtained for K_0 and K_3. In the second, K_2 was set equal to zero, and a least-squares fit obtained for K_0, K_1, K_3. In the third case, a least-squares fit was obtained for all four K's. Data used to determine the coefficients were those lying above the horizontal lines of the table, specifically 1947–1955 for the first formula, 1947–1956 for the second, and 1947–1957 for the third. The deviations from actual values are indicated. The least-squares fit minimized the sum of the squares of eight residuals in each case. The sum of those eight squares is listed in the table as S^2 for each fit.

The technique thus consists in representing the forecast as a weighted average of one or more of the most recent observations with an additive constant. Such forecasting from a moving average differs from the more familiar process for projecting trends in that the weights assigned may vary markedly from each other and some may be negative. In both cases for which K_1 appeared in Table I, for example, it was assigned a negative value.

The process involves determining the weights K_0, K_1, K_2, etc., by standard least-square procedures for a historical period and then using these as weights or constants in a moving average formula to generate forecasts for the next period from the most recent observations.

A number of observations, together with knowledge of the weights, would suffice to determine the future shape of the curve produced by the forecasting formula. It turns out that any such moving average formula using two or more observations may suffice to describe a series following a linear trend plus a true cycle. In fact, the formula using three observations for the population series produces a cycle with variable amplitude, fixed frequency, with the oscillation being about an exponential growth rate. In general, a great number of different curves can be determined from a given set of K's, the individual shapes depending on the observations. If the oldest observation is dropped and the first forecast is treated as a new observation, the set of remaining observa-

TABLE I

TEST OF FORMULAS FOR FORECASTING U.S. POPULATION*

Year	Population (in thousands)	Formula 1 Estimate Error (in thousands)	Formula 2 Estimate Error (in thousands)	Formula 3 Estimate Error (in thousands)
1947.....	143,446			
1948.....	146,093	145,844 −249		
1949.....	148,665	148,554 −111	148,530 −135	
1950.....	151,234	151,187 − 47	151,135 − 99	151,012 −222
1951.....	153,384	153,817 433	153,769 +385	153,692 +308
1952.....	155,761	156,018 257	155,790 + 29	155,738 − 23
1953.....	158,313	158,452 139	158,328 + 15	158,419 +106
1954.....	161,191	161,064 −127	161,022 −169	161,071 −120
1955.....	164,303	164,011 −292	164,116 −187	164,140 −163
1956.....	167,261	167,197 − 64	167,410 −149	167,368 +107
1957.....	170,293	170,225 − 68	170,376 + 83	170,296 − 3
1958.....	173,260	173,329 69	173,518 +258	173,512 252
		S^2 = 450,783	S^2 = 263,048	S^2 = 208,340

Formulas

1. $P(t+1) = 1.023759\,P(t) - 1010$
2. $P(t+1) = 1.462378\,P(t) - .436771\,P(t-1) - 2460$
3. $P(t+1) = 1.467257\,P(t) - .722990\,P(t-1) + .291043\,P(t-2) - 3243$

* Source: *U.S. Population Excluding Armed Forces Overseas*, U.S. Census Bureau.

tions plus one forecast can be inserted in the recursion formula to obtain a forecast for a second month. Proceeding in this way by successive steps all based on the same K's, a projected time series out into the distant future can be obtained. This series will exhibit the cycles and explosive characteristics determined entirely by the weights. Its exact level and the amplitudes of the cycles will be highly dependent on the recent history used for the initial set of observations.

Further insight into the range in behavior of such forecasting formulas may be provided by examination of a special form given by

$y(t+1) = y(t) + K\,[y(t) - y(t-1)] = (1+K)\,y(t) - K\,y(t-1)$.

The behavior of this expression depends greatly on the value of K and the initial increment

$I_0 = y(t) - y(t-1)$

since later increments are given by

$_tI = y(t+1) - y(t) = K[y(t) - y(t-1)] = K\,I_{t-1}$.

Let us consider nine different cases:

1) $K = 2$, I positive.

All subsequent increments are positive and increase in size.

2) $K = 2$, I negative.

All subsequent increments are negative and increase in absolute magnitude.

3) $K = 1$.

All increments are equal to I and a straight line is generated.

4) $K = \frac{1}{2}$, I positive.

All subsequent increments are positive but decrease in size.

5) $K = \frac{1}{2}$, I negative.

All subsequent increments are negative but decrease in absolute magnitude.

6) $K = 0$.

All subsequent increments are zero and the function generated is a constant.

7) $K = -\frac{1}{2}$.

Increments reverse in sign and oscillations are generated but damp out.

8) $K = -1$.

Increments reverse in sign but retain the same absolute magnitude giving a stable cyclic movement.

9) $K = -2$.

Increments reverse in sign but are of increasing absolute magnitude generating an unstable explosive oscillation.

More complicated formulas with more K's, that is more weights, and correspondingly more observations in the moving average will generate more complex behavior with superimposed oscillations of either damped or explosive character.

We have seen how this procedure works for a single series. If we are concerned with a number of different series, say demands for a class of thousands of line items with similar periodicities, a single forecasting formula of the type considered with a single set of weights will suffice for all series of the group regardless of differences in average demands or trends or even the relative amplitudes of their cyclical movements. Historical data on all of these series or a fair representative sample could be used to determine the weights by one least-squares fit to this full mass of data. This is the great convenience of the method—a single set of coefficients, the weights, can be preset into a computer routine and a few observations on the most recent history of the series cranked in to give relatively good forecasts for each item. Since the weights generate a difference equation, the general form of the function is determined entirely by them. Given enough observations to start the step-by-step development of the function, successive applications of the formulas will trace out future forecasts in a predetermined manner.

As described above, it is possible to generate, through a step-by-step process, a sequence of successive forecasts using only the weights and a corresponding number of most recent observations. This is accomplished by dropping successively the earlier observations and adding successive forecasts, while advancing the weighted moving average. The weights upon which the moving average depends are determined once and for all from all data on all series. In theory, this process can be continued indefinitely. In practice, however, it does not work very well for more than a few steps into the future, since its accuracy diminishes rapidly as forecasts replace actual observations. This situation is not helped appreciably by using a large number of terms (that is, weights and observations), since that would introduce a large number of cyclic components not well aimed by the limited observational data processed in the recursion formulas. In general, therefore, use of from four to six terms seems to be most efficacious.

To check the advantage of adding extra terms and to obtain a measure of the validity of the whole procedure, it is desirable to run sensitivity tests by attempting to predict a recent period with weights derived entirely from data for earlier periods. Repeating such tests with a different number of weights also provides insight into the stability of important cycles.

The computational work involved in computing a set of six weights is exactly equivalent to that of fitting a sixth-degree equation (a sixth-degree polynomial) to the whole set of data. This action is not difficult on a computer. It is thus feasible to try several experiments testing different numbers of terms and different periods. The advantage of the moving-average technique is that one set of weights applies to a whole class of series, provided only that their periodic patterns are drawn from a given set of frequencies. Had ordinary polynomials been used, a separate fit would be required for each series.

The method described has been tried experimentally with reasonable success for a sample of the chemical-demand forecasts and will be used as input for a production-scheduling system. Further experience will show how well it works on a full variety of items.

Summary

Let us now summarize by listing some general comments on the two methods of forecasting and some contrasts between them.

1. In the case of pattern groupings, the series for items within a pattern tended to have the same seasonal, and to some extent each tended to enjoy a constant share of the total. Had the recursion formulas been used, they could have been fit to each pattern as a group. This would have permitted each item's recent history to determine its share of the total, the amplitudes of its seasonals, and (on summation over items) the general pattern forecast.
2. Both methods are reasonably easy to apply. The recursive formulation is more mechanical and less capable of adjustment to agree with projected totals or to respond to qualitative information such as salesmen's estimates. On the other hand, the formulas are more universal, the form of the recursive function is the same for all items, although the number of non-zero weights and their numerical values would vary from group to group. The only place for human intervention is in selection of the class grouping.
3. The recursive formulas generate semi-independent series for each item and do not force the extrapolations to agree with the marginal totals projected for classes or groups. Totals may be obtained by summation if needed. The flow here is from the detail to the whole, rather than by allocation of a projected total among its elements, as in the dinnerware case.
4. If recursive formulas with only five or six terms are used, the series are based to a great extent on the last few observations. If daily forecasts were being prepared, this would amount to giving great weight to the most recent week. The series generated would probably fail badly after a few weeks except in very stable situations. Holidays and other special events would also have too great an influence. These difficulties do not arise in anything like this degree for the dinnerware procedure.

Both procedures have merits for mass forecasting. The fact that a great deal of important qualitative and intuitive information was available in the dinnerware case, i.e., information about planned promotions, made a more flexible system very appropriate. For large inventory problems presenting little opportunity for collecting collateral information, the recursive autocorrelation technique is very convenient.

The recursive technique is closely related to harmonic analysis or serial-correlation techniques used in weather forecasting and other mass applications. For short-run economic forecasts, it appears to have a place. It is useful in general whenever the time horizon of the projections are such that impending shifts due to changes in underlying circumstances cannot be anticipated in sufficient quantitative detail (both as to magnitude and timing) to serve as a useful basis for adjusting mechanical forecasts.

The recursive technique has little advantage for forecasting single isolated series, particularly stable ones such as that in the population example. It does become extremely efficient when a mechanizable procedure is needed for forecasting the demands of thousands of individual inventory items on a weekly, monthly, or quarterly basis. Since the same weights may be used for a whole class of items and need not be redetermined very frequently, the recursive moving-average technique is very easy to apply. Such techniques may find increasing application in the future.

APPENDIX
Calculations for Table I

To illustrate the computations involved in the autoregression problem, we present an outline of the calculations from which Table I was derived. To obtain the first column of Table II, that is, the column labeled $P(t + 1)$, let us subtract 140 million from all populations given for the years 1947–1957 inclusive. Now by advancing each entry one line, we obtain the second column of Table II, that is, the column labeled $P(t)$. Similarly, the third column of Table II, labeled $P(t - 1)$, is obtained by again advancing each entry one line. Finally, $P(t - 2)$ is obtained by another advance, and written in the fourth column of Table II.

TABLE II

WORKING DATA* FOR AUTOREGRESSION EXAMPLE

	P(t+1)	P(t)	P(t-1)	P(t-2)
1947	3446			
8	6093	3446		
9	8665	6093	3446	
50	11234	8665	6093	3446
1	13384	11234	8665	6093
2	15761	13384	11234	8665
3	18313	15761	13384	11234
4	21191	18313	15761	13384
5	24303	21191	18313	15761
6	27261	24303	21191	18313
7	30293	27261	24303	21191

* Entries in column headed $P(t + 1)$ give U.S. Population (cf. Table I) less 140 million (expressed in thousands). Same data are repeated in subsequent columns with successive one-year advances of data.

Note that for a projection formula with three weights plus a constant, K_3, we will use the four columns enclosed in the large rectangle for years 1950–57 inclusive. For a formula with two weights plus a constant, K_3, we will use only the last three columns of this large rectangle, since these are identical with the entries in the smaller three-column rectangle, for years 1949–56 inclusive, labeled with (2) at the vertices. The rectangle labeled with (1) at the vertices suffices for a formula with a single weight and the entries in this rectangle are identical with those in the final two columns of rectangle (3).

Let us first consider the projection formula with three weights plus a constant. Note that the column sums from rectangle (3) are as follows:

$$\sum P(t+1) = 161{,}740 \text{ summing Column } P(t+1) \text{ of } (3);$$

$$\sum P(t) = 140{,}112 \text{ summing Column } P(t) \text{ of } (3);$$

$$\sum P(t-1) = 118{,}944 \text{ summing Column } P(t-1) \text{ of } (3);$$

$$\sum P(t-2) = 98{,}087 \text{ summing Column } P(t-2) \text{ of } (3).$$

We use these sums eventually in obtaining K_3 but initially to obtain

$$8[\textstyle\sum P(t+1)\,P(t)] - [\sum P(t+1)]\,[\sum P(t)]$$
$$= 8(3{,}138{,}692{,}095) - (161{,}740)(140{,}112) = 2{,}447{,}821{,}880$$

$$8[\textstyle\sum P(t+1)\,P(t-1)] - [\sum P(t+1)]\,[\sum P(t-1)]$$
$$= 8(2{,}699{,}532{,}208) - (161{,}740)(118{,}944) = 2{,}358{,}255{,}104$$

$$8[\textstyle\sum P(t+1)\,P(t-2)] - [\sum P(t+1)]\,[\sum P(t-2)]$$
$$= 8(2{,}270{,}387{,}966) - (161{,}740)(98{,}087) = 2{,}298{,}512{,}348$$

$$8\textstyle\sum [P(t)]^2 - [\sum P(t)]^2$$
$$= 8(2{,}747{,}047{,}938) - (140{,}112)^2 = 2{,}345{,}010{,}960$$

$$8\textstyle\sum P(t)\,P(t-1) - [\sum P(t)]\,[\sum P(t-1)]$$
$$= 8(2{,}365{,}670{,}467) - (140{,}112)(118{,}944) = 2{,}259{,}882{,}008$$

$$8\textstyle\sum P(t)\,P(t-2) - [\sum P(t)]\,[\sum P(t-2)]$$
$$= 8(1{,}993{,}181{,}019) - (140{,}112)(98{,}087) = 2{,}202{,}282{,}408$$

$$8\textstyle\sum [P(t-1)]^2 - [\sum P(t-1)]^2$$
$$= 8(2{,}041{,}010{,}466) - (118{,}944)^2 = 2{,}180{,}408{,}592$$

$$8\textstyle\sum P(t-1)\,P(t-2) - [\sum P(t-1)]\,[\sum P(t-2)]$$
$$= 8(1{,}724{,}142{,}862) - (118{,}944)(98{,}087) = 2{,}126{,}282{,}768$$

$$8\textstyle\sum [P(t-2)]^2 - [\sum P(t-2)]^2$$
$$= 8(1{,}462{,}249{,}573) - (98{,}087)^2 = 2{,}076{,}937{,}015$$

These quantities are now coefficients in the "normal" equations for determining K_0, K_1, K_2, as follows:

$$2{,}345{,}010{,}960\,K_0 + 2{,}259{,}882{,}008\,K_1 + 2{,}202{,}282{,}408\,K_2 = 2{,}447{,}821{,}880$$

$$2{,}259{,}882{,}008\,K_0 + 2{,}180{,}408{,}592\,K_1 + 2{,}126{,}282{,}768\,K_2 = 2{,}358{,}255{,}104$$

$$2{,}202{,}282{,}408\,K_0 + 2{,}126{,}282{,}768\,K_1 + 2{,}076{,}937{,}015\,K_2 = 2{,}298{,}512{,}348$$

These equations are symmetric and may be solved by the Doolittle method or by simple elimination to obtain

$$K_2 = \quad .291043$$

$$K_1 = -\ .722990$$

$$K_0 = \quad 1.467257.$$

For K_3 we have

$$\begin{aligned} 8K_3 &= \sum P(t+1) - K_0 \sum P(t) - K_1 \sum P(t-1) - K_2 \sum P(t-2) \\ &\quad + 8(1 - K_0 - K_1 - K_2)(140{,}000) \\ &= 161{,}740 - (1.467257)(140{,}112) + (.722990)(118{,}944) - (.291043)(98{,}087) \\ &\quad - 8(.03531)(140{,}000) \\ &= -\ 25{,}940 \end{aligned}$$

or

$$K_3 = -3{,}243$$

For the case of only two weights, the normal equations for K_0, and K_1, are:

$$2{,}180{,}408{,}592\ K_0 + 2{,}126{,}282{,}768\ K_1 = 2{,}259{,}882{,}008$$

$$2{,}126{,}282{,}768\ K_0 + 2{,}076{,}937{,}015\ K_1 = 2{,}202{,}282{,}408$$

from which

$$K_1 = -\ .436771$$

$$K_0 = 1.462378$$

and

$$\begin{aligned} 8K_3 &= \sum P(t+1) - K_0 \sum P(t) - K_1 \sum P(t-1) \\ &\quad + 8(1 - K_0 - K_1)(140{,}000) \end{aligned}$$

where the sums refer to the second, third, and fourth columns of Table II previously labeled $P(t)$, $P(t-1)$, and $P(t-2)$.

Thus,

$$\begin{aligned} 8K_3 &= 140{,}112 - (1.462378)(118{,}944) + (.436771)(98{,}087) \\ &\quad - 8(.025607)(140{,}000) \end{aligned}$$

or

$$K_3 = -\ 2460.$$

Finally, with only one weight K_0 we have

$$2{,}076{,}937{,}015\ K_0 = 2{,}126{,}282{,}768$$

or

$$K_0 = 1.023759$$

and

$$8K_3 = \sum P(t+1) - K_0 \sum P(t) + 8(1 - K_0)(140{,}000)$$

where the sums refer to the sums of columns originally labeled $P(t-1)$ and $P(t-2)$.

Thus,

$$8K_3 = 118{,}944 - (1.023759)(98{,}087) - 8(.023759)(140{,}000)$$

or

$$K_3 = -1{,}010\ .$$

Seek not to learn, but to think; seek not to accept, but to question and solve.

Robert G. Sproul

The Staggering Problems in Managing National Defense

EDWIN B. GEORGE

An eye-opening appraisal of our national defense posture—and the staggering management problems it presents—by the Chairman of the Program Advisory Committee, Office of Civil and Defense Mobilization.

In setting up military defenses, the United States Government is not dealing with firm values. Policy on defense posture itself is deployed in a two-front struggle. On the one hand, this nation, as every other nation, must normally take calculated risks because of the impracticability of setting up perfect defenses against all contingencies. On the other hand, particularly as of now, many weapon concepts have been developed to the point that operating forces are demanding heavy production and sometimes premature adoption. The management problems thus thrust on the armed services are complicated by a prospect of flat appropriations over the next few years. At the Federal executive level, allocations of revenues and resources by the President and Congress will have far-reaching effects of so sophisticated an order that the general public will seldom appreciate their source.

More distinct problems, however, are created for business managers. Business management policies must be flexible enough to adjust to a national defense program that is liable to jump, sag, or change shape. The ease with which the defense program can fluctuate will be better understood in light of the following analysis.

In a recent pamphlet, "The Defense We Can Afford," the Committee for Economic Development concluded that our resources were not yet severely strained, and that we could afford what we had to afford. The authors clearly meant also that outlays should be not more than commensurate with the crises faced, and they explored and urged many economies. But a few extra problems likely to perplex readers can be put together from the following facts and inferences: (1) There is never any precise stopping point to a strong defense; (2) even a rich society, therefore, must ration its meager billions among alternative strategies; (3) our cultural lags hinder the development of a balanced defense; (4) massive spending is not the only way to chase the specter of mutual nuclear destruction.

No Logical Limits to "Military" Defense

The group of business leaders that comprised the Committee had to make do with broad illustrations in such a short pamphlet, but these illustrations were vivid enough. Several sets of apposition seemed to emerge. Present versus future defense efforts are exemplified by the rival claims for immediate striking power and for research and development. Arguments over our present defense posture pit a combination of mobile ground forces and tactical air forces for local combat duty against nuclear power as the best deterrent to any kind of attack. Longer-view planning ranges from protection of people and property from massive destruction (plus

reconstruction) to crash development of any weapons showing promise of being able to wipe out much of the human race. All compete for funds.

Needless to say, the whole complex shrinks the well-being of the American people, or rather, slows its expansion. Ten percent of our national output goes into defense, and what if Russia is investing far higher proportions—damage is done. Our 10 percent also draws disproportionately upon our highest skills. And it can be assumed that our sense of morality is coarsened by the dedication of perhaps half of our technology and much of our intellect to destructive aims. We accept these losses only because the competing value on this plane happens to be survival, and we are at least partially compensated on the physical side. The research going into defense is also a social investment with returns in the unorthodox but exciting form of knowledge upon which private business is drawing heavily to general benefit.

How Much for the Military?

Actually the rivalries are promiscuous—each against all—and not duels. All flow from the fact that we have to prepare for so many kinds of war at once and are given no choice of peace.

This writer has been reading bitter editorials and addresses lately about both the inadequacies and insatiability of defense. In both views we are taking grave risks—in one on survival, in the other on solvency. Actually, few of these public pronouncements provide a basis for resolving the real conflicts illustrated above. The things we can think of doing are so limitless that all the money anyone would want to pour into defense could exploit only a few of them.

Even within the present limits of knowledge and strategy we could embarrass ourselves, such as by substantial enlargement of conventional forces and weapons and a crash production program for all existing models of missiles and their even more expensive launching apparatus. In moderation, step-ups in both directions are currently being urged, but runaways are easy. Our missile outlays are already over a hundred times as large as in 1951, and perhaps ten times as large as those of 1954. Also rising steeply are outlays for anti-missile defense, such as radar networks, picket ships, and anti-missile missiles, not to mention the prospect of possibly a few dozen atomic-powered submarines capable of launching missiles. None of this is being criticized at the moment; the history is merely being used to show that even the programs in being are exponential.

Beyond them, a plain enough glimpse of what the future could hold is afforded by the potentialities of electronic computers and controls, space travel, controlled fusion, new fuels and metals. In these areas we are already hard to startle. Now think of reconnaissance satellites, inaudible supersonic whistles capable of giving us 175 million headaches, manned hypersonic planes (hybrids of space ships and aircraft), toxicological warfare, temporary mass sedatives, willpower sapping drugs, radical control of weather.

Think of the horizontal effects of a spread of nuclear knowledge and technology to small nations. The origin of a bomb might never be known until after no one cared. In times of uneasy balance, a major war could be triggered by unknowns. Improvements and the now familiar process of reducing pioneering models to miniatures, may eventually bring a still horribly effective apparatus within reach of rebel, or even criminal bands. A Central European firm is already reported to have sold guided missiles to several countries. The world will have to be much smarter collectively than it has been as a congeries of bickering nations to control all the convenient means of destroying itself.

One may not have to wait so long for economic fantasia. A French general found it in the simple arithmetic of a future missile duel. Retaliatory weapons should eventually be

small and mobile, and producible in great quantities. To destroy four thousand of them spread throughout the United States, the Soviets would have to fire fifty to sixty thousand missiles almost simultaneously. For accuracy in a ground-level explosion of the nuclear warhead, the number would have to be much larger. A Western counter-offensive against the minimum of fifty thousand enemy sites would need perhaps a half-million or more Allied sites. The general was a thorough man, and actually carried his astronomic estimates much further. But even prosaically, both "sides" could be forced into ruinous expense.

In such a perspective, the Rockefeller Brothers Fund recommendation for $45 billion increased expenditures over the next five years and, reputedly, the Gaither Committee recommendation for somewhat larger amounts for arms plus $22 billion for shelter construction become modest. Certainly we could "afford" such sums, if necessary and with suitable monetary and fiscal safeguards, but must we, and is evolution going to respect our stopping points?

Sample Choices Among Strategies

The debates of the past year have featured such questions as whether solid propellants, such as for the Navy's submarine-borne Polaris, will in time replace the unwieldy liquid propellants now generally used in land-based missiles, and whether the days of manned bombers are numbered—with strong voices supporting the negative in both cases. And a more immediate and serious controversy, too commonly cramped into the jargon of economy vs. defense, has raged over the number of missile types that we should develop. The subject is intricate, and only illustrations will be used. The (ICBM) Atlas is available, but among its weaknesses is a sprawling and vulnerable above-ground installation which, however, can be toughened and eventually modified for underground deployment. The (ICBM) Titan will have extra payload capacity, corresponding diversification in use, and concrete-lined underground silos, and in general can be more of a super-weapon; but it still has some distance to go before completion. The Polaris (a mobile IRBM), with its solid propellant, is reaching the final stages of development as will, in time, the much simpler (ICBM) Minuteman, capable of being produced in large numbers. (In another medium, the bombers of the Strategic Air Command can inflict total damages.) But the timing of the newer models is uncertain, and there could be a fatal gap unless we stock up with what we have—which Russia is supposedly doing at great expense. And there are, of course, many other difficult choices. Again, what should we do and where should we stop?

Naturally, questions of cost enter into such decisions. They grievously complicate the problem of how to phase models into each other at different stages of development through shifting degrees of menace. Officers in high positions offer such arguments for moderation in early production goals as: "There is little point in producing more weapons than can destroy the enemy;" "Let us avoid the overkill at the expense of versatility;" "Our need is not for numbers but for invulnerability." The virtues of duplication oppose this caution. Duplication is waste, but not entirely or predictably. It is not psychopathic to freeze one design and seek new technical discoveries through another. When does further play to rival ideas for exploring the unknown become too expensive? Where billions are involved, this question could unsettle any mind. The time phasing of successive models by tests of need both for weapons on hand and for chain improvements in design—tests that shift in relative value with kinds and degrees of peril—must finally be resolved in terms of money.

There are specific hazards, for instance, against which the degree of defense or retaliatory ability we provide lies within our discretion, and with respect to which we ac-

cept calculated risks. The current tendency to hold the production of Atlas missiles below capacity, presumably because of the probability that they will be obsolesced before long by better hardened or more maneuverable models, is a dramatic case, but the point can be made even when confined to the problems of balance within a single service.

The Navy's Polaris nuclear missile, launched principally from nuclear-powered submarines, is a fearsome weapon. The *George Washington* will be the first Polaris-launching nuclear sub. The advent of nuclear subs has been hailed as one of the greatest military innovations of all time. The missile has been successfully tested under simulated conditions. So how many should we build?

The answer depends in good part on how many means of killing the enemy we choose to finance. On land, it is proposed to build the Atlas, Titan, and Minuteman to such capability. At sea, the big carriers with their low-level assault planes can deliver a powerful punch. The Air Force has concentrated heavily—too heavily, in the judgment of some experts, and at the expense of tactical strength—on a capacity to devastate enemy cities and military emplacements. Each command is confident of its ability to inflict intolerable retribution on any missile-happy adventurer. Yet many Naval officers tend to discount the reliability of rival systems of destruction and would make Polaris a total deterrent by itself should an enemy calculate that he could knock out everything else. This tendency signifies a belief that the names and addresses of all land launchers would be known to Moscow; that with presently attainable precision, most of them would be knocked out by nuclear assault; and that, in the end, Polaris would have to do the retaliatory job anyway. It is a short step from this belief to the sequel belief that further hardening of the Atlas and Titan and efforts to give wide-ranging mobility to Minuteman are steps in the wrong direction, and that the precious funds so consumed should go to the Navy; it would need the funds, since Polaris-carrying subs are quite expensive (about 100 million dollars per sub), and estimates of the number required for a thorough job run into several dozens. At least nine are expected to be operational by 1963, and lead components for several more are being funded.

But the basic question before the reader throughout this article is what constitutes "adequate defense" and how much should be spent for it. And would the pace of technology warrant compromise between the sense of urgency all of us feel so strongly and the likelihood of early obsolescence in the good weapons we could now turn out rather quickly? Such are the considerations facing policy makers who at the same time must answer charges of "failing to close the missile gap." Even the discovery of some costless way of unbalancing budgets or of raising taxes would not make the choices easy, although budgets are producing some disconcerting side effects. Missiles, rockets, satellites, Polarises, and their like have come to be known as "glamour-pusses" within the services, and the comparative ease with which appropriations can be obtained for them has sometimes pinched other basic defense projects and made for imbalance. But again, where is the logical stopping point to how much should be paid for defense in the aggregate or for any part of it, and if more is considered necessary, how should it be financed? We could raise taxes, cut welfare programs, eliminate wastes in both defense and basically good social programs that are protected by the Congress itself, or finance through inflation. These questions are separable only in political addresses.

Another example: the big carrier is now queen of the Navies. The battleship is gone. The stress in the carrier is on power and versatility. She carries powerful and elusive low-altitude attack bombers, long-range bombers, anti-sub and ground-support bombers, air

and sea fighters. She is ready to cover Marine and Army landing forces, support indigenous forces under Communist border pressure, play a major role in general war, throw H-bombs if necessary. One Forrestal-type carrier is nuclear powered and, therefore, is capable of cruising indefinitely without reliance on politically insecure foreign bases.

The carrier sounds like a fighting paragon, and in many respects she is. Then why not give the Navy the minimum of fourteen large carriers that she wants, and even four additional for the Indian Ocean, instead of the mere nine in existence or committed? One answer is the persistence of controversy over the ability of the carrier to defend itself against modern weapons. Her champions scorn such criticism, stressing the enemy's problems of singling her out of the fleet and of getting and holding a fix on her, a moving target; her great mobility; and her own murderous defense and attack power. For the most part, the Air Force and Army remain unconvinced. They believe they can get more defense value out of their own wares for the same large sums required to support the delicate sea queens. And additionally, the carrier needs an escort of destroyers, subs, and other vessels which have to be counted in the capital and operating costs chargeable to her. Finally, the Navy wants at least two major carriers for each deployed fleet continuously. This number is required because of periodic overhaul problems and tactically because carriers synchronizing with each other are believed to be twice as deadly as the same two carriers acting separately. This normal and proper confusion of counsel is not the least of decision-makers' troubles in fixing a stopping point for defense. A while ago, the Navy was trying to divert to itself at least a part of the sums now devoted to building and hardening land-based missiles. Parenthetically, both the Army and the Navy would like to have the money now spent on the Bomarc anti-aircraft-and-missile installations, which they regard as relatively ineffective.

The same contrariety runs through military opinion on Marine requirements; on versatile-large vs. special-purpose small ships (notably carriers, destroyers and submarines), and on production vs. research. The decisions ultimately to be made by civilians are far from being doctrinaire.

How Much for "Non-Military" Defense

The essentiality of non-military defense seemingly has to be relearned in every war. Bernard Baruch achieved fame in World War I by organizing and dramatizing this function. Even so, it took a while in World War II for even eminent civilians to understand that the military was the fist at the end of the industrial arm, and that coordinating the two in total war really meant controlling the flow of materials from mines and farms to ultimate weapons with no step less important than the last one. At the onset of the Korean crisis, a hurried Congress set up two incongruous agencies—the Office of Defense Mobilization and the Federal Civilian Defense Administration—with overlapping powers. Since actual fighting was confined to the Korean peninsula, this illogical setup didn't matter greatly at the time, but in eventual realignment to face threats of nuclear war, a more logical remedy, that of merger of the two agencies, was adopted.

How much expense should now be tolerated to provide industrial, economic, and social back-up for a military strategy of making war by holocaust? It is wrong to charge military and civilian authorities with attitudes set to refight World War II (as is sometimes strangely done) but as regards the old problem of blending military and non-military defense into a seamless plan of action, the proportions have not changed much. Strategy in World War II did not seriously consider wholesale destruction of the homeland. Strategy for World War III does. Yet current

appropriations exceed $46 billion in the aggregate for military and ancillary needs, and around $50 million for Federal shares of the non-military complement.

In the face of this mismatch, it is surprising that the old FCDA was able to accomplish as much as it did. It has at least planted in the public mind—perhaps perversely—an awareness of the frightful correlations between megaton yields from the nuclear weapons and the numbers of people who would be killed by them. The possible perversity derives from the feeling of near-fatalism thereby engendered in a normally cocky public. The feeling of many people that they don't care to survive chaos could give way to familiarity with even that specter and to the therapy of work to be done. For it is not true, as yet, that the bulk of the population would inevitably be killed. Most of those in the radius of blast, heat, and intense radiation would be killed, yes. But for the majority of people survival is still probably up to themselves. Protection is feasible.

At any rate, independently and in close cooperation with state and local governments, the OCDM has made elaborate provisions for continuity of governments; assisted industry in hardening plants, preserving records, and providing for managerial succession; has established monitoring stations that by 1961 will number 3,000; has bought 800,000 radiological instruments for state and local governments; has delivered radiological kits to 15,000 high schools and arranged instruction for more than one million students and more than 100,000 city and state employees; will have soon issued 3,200,000 survey instruments to Federal, state, and local agencies; has stored over 160,000 tons of medical supplies (including 1,932 emergency hospitals with a capacity of two hundred beds each) in Federal warehouses; has developed a national warning network in cooperation with the Air Force; has provided for emergency communication and for early restoration of transportation, utilities and other essential community facilities; has planned mobility for food stocks; has envisaged rudimentary fiscal, monetary, and financial systems; and much else.

The flaw is that it is all done in a spiritual vacuum. The program is urged on the people by the Government, not required of the Government by the people. The public will to resist aggression, which many signs show to be as vital as ever, always has trouble keeping up with the practicalities of resistance. The imbalance in appropriations between military and non-military defense is probably good democracy. It reflects the lag in cohesion during our past two wars and now serves as evidence that the concept of total war is still a phrase with a meaning hard to grasp. Where are the shelters? Of what good is the big catalogue of FCDA accomplishments, or ultimate missiles, for that matter, without them? If we are caught without shelters, the fatalists would win the big argument by default (and also posthumously). There *can* be legitimate doubt over the wisdom of delaying any major construction program for another year or so because of the rapidity with which scientists are learning to improve designs, but the issue, then, is the familiar one of calculated risk rather than of war strategy.

All Presidential advisory committees, invariably composed of distinguished citizens, have recommended shelters. The Russians are known to be building them on an extensive scale. Sweden (and Norway) can already billet a large percentage of her population in well-planned underground structures. We simply debate. Certainly something has been done. We have developed community and home models, have learned at atomic testing grounds to draw specifications for structures and equipment in fine detail, are now surveying the conversion capabilities of existing buildings, estimating the costs of building self-contained shelters into new federal structures, building prototypes for home owners and encouraging private builders to

incorporate them. Until recently, however, the Federal Government itself set no example. The new State Department Building, where decisions for war or peace may be made for the world, has no shelter. However, provision is now made for shelters in buildings funded for fiscal 1961; the FHA now allows the costs of shelters to be included in the housing costs that it insures; several other Federal agencies have included shelters in the programs to which they give financial and other types of support under their respective statutes.

Aside from economy, the main reason for the reluctance of the Government to proceed even more vigorously with shelter construction is supposedly fear of alarming the Kremlin—possibly to the point of precipitating a surprise attack. It is difficult to understand how such passive action could stir more alarm than the ring of bases from which we could drop several thousands of megatons of nuclear explosive energy on Russian cities. Presumably an answer can be found somewhere in the nuances of diplomacy. Some undiplomatic people are surprised because they can see another kind of contradiction in our caution, stemming from our widely advertised dependence on nuclear capability as a deterrent to aggressors, viz.: Is possession of missiles by us really a deterrent when lack of protection against them can be construed either as a secret intent to strike the first blow (a suspicion that might provoke panicky action by the enemy in one of our interminable crises) or as lack of genuine resolution on our part to face an ultimate test (which could invite piecemeal aggression through use of the enemy's superior land powers). Actually, our situation is that we are depending heavily upon an ultimate weapon without will to use it except in retaliation. This would be the policy of the American heart that will probably rule its mind. If we are to accept the first blow, does the same humanitarian attitude forbid us to minimize its effects?

Imbalance Within Non-Military Defense

There has also been some imbalance within the non-military defense program itself which, however, seems on the way to being corrected. It is plain enough rationally that, even in demonic war, we will not be saving people and resources only for the purpose of letting them exist. They will be saved for the purpose of recreating a living society in the image of our ideals, of restoring useful production, of reknitting the fragments of a shattered nation. This goal requires preparations for *reconstruction in depth* of both physical plant and social institutions. Much of this kind of reconstruction requires stockpiling the thinking of imaginative people in many businesses and professions, rather than simply stockpiling physical goods. Some of the latter will be needed, but these goods will bear no relation to the still useful but partly outmoded and partly political $6 billion stockpile already accumulated, and sensibly acquired, the goods will cost only millions. Their nature can be worked out by the reader himself from the following illustrative list of unsolved problems still besetting non-military defense planning and possible ways of solving the problems:

1. *Psychological:* Probe the mental defenses that people set up against defense measures through study of past research on public attitudes supplemented by depth interviews. Utilize past empirical work on human behavior in disaster and send task forces instantly to scene of a major disaster—not after order is restored as heretofore. Appraise patterns, ideas, institutions, and values that have played major roles in preserving our democratic free enterprise system. How can we best exploit and carry over into chaos such familiar attachments and faith?

2. *Post-Attack management organization:* This is the task of political scientists in advisory roles to the OCDM. How can we best

prepare surviving government personnel at all levels for service in tragic new tasks?

3. *Teams of field inspectors to appraise attack damage:* These must be recruited from industry. They will be practiced in the use of air surveys for initial guidance, and a pre-attack *esprit de corps* must be methodically built. The aim must be to restore intricate chains of production, however "jerry-built."

4. *Existing Stockpiles:* How are administrators in stricken and isolated areas to use them without criteria of relative end-use urgency and of economy in use? Inequities and waste of priceless resources would otherwise be certain.

5. *Rehabilitation of heavily damaged plant capacity:* There must be schedules of relative values, stress on simplicity within starkly limited scopes of restoration, cannibalization of broken equipment, and advance action to break bottlenecks in capital goods replacement.

6. *Money compensation for attack damage:* Should there be any? How substantial should it be? Such consideration would be sometimes essential, sometimes dangerous, and always a burden on a crippled financial system. This is a major and controversial problem needing help from experts in both casualty insurance and fiscal policy.

7. *Insurance moratoria, deferments, continuity:* We must develop, before attack, a policy that can be applied at all levels without the help of proclamations.

8. *Money supply:* This whole question is still unsettled. Even in pandemonium our money must command confidence and be available in the right quantities for the prevailing conditions. Otherwise, the pandemonium would be worse, and recovery plans would be seriously hampered or frustrated. To this end, should government validate the money supply through underwriting the properties that underlie it and then ration the supply that is thus validated? But conversely, it is sometimes asked, in such circumstances can we operate a money economy at all? The answer seems to be yes.

9. *Semi-military labor battalions:* There has been talk of pre-recruited flying squadrons of multi-skilled workers—maybe 100,000, with a practical limit set by transport facilities. A dozen major questions are involved.

10. *Discovery of short cuts in projecting data flows in a post-attack period:* The data would have to be limited and vital, available on local levels. Data on inputs by type and quantity into essential end-products must be included. Inventories are the most obvious general case.

11. *Production directives:* Critical needs for undamaged and partially damaged areas must be anticipated and weighed.

12. *Rationing:* There must be rationing, but nothing like we have known in a cohesive economy. Presumably, there would have to be different standards for areas suffering different degrees of damage.

13. *Island of authority:* In stricken areas, there will be conflicts of authority among governors, mayors, and legislators, Army area commands, regional directors of OCDM, field representatives of Federal departments and agencies. Much has been done to reconcile these conflicts, much remains to be done. All must be tested and retested.

14. *Study of rehabilitation bottlenecks:* It has been established that for lack of key equipment, a six-to-twelve-month reconstruction job could drag out for eighteen to thirty-six months. Specialized machinery with long production cycles could be stockpiled in relatively small quantities. (Old models would do.)

15. *Food supply—requirements:* Can present stocks be redistributed in advance?

16. *Military requirements and production policy, post-attack:* The first need is for complete information on pre-attack stocks and capabilities. The second is provision for replacing such stocks out of surviving and reassembled equipment.

17. *Post-attack flow of export-import trade:* There will be some flow of trade, e.g., somehow or other our foodstuffs must get to friendly countries, now doubly linked with us in disaster, and there are survival goods from friendly but possibly unattacked nations that we must have. The concept spills over into military personnel and materiel and to manpower. There must be pre-planned use of the instruments of embargoes, seizures, port controls, self-triggering orders, financing.

18. *Executive reserve training:* There are now several hundred reservists of this type. These are practical men, selected in the main because of demonstrated capacity in dealing with emergencies, and they are not interested in being praised for devotion to their country or in being exhorted to endeavor. They want to help solve real problems, and a few of the foregoing problems have already been assigned to groups of these men for study.

These eighteen examples of non-military defense problems have actually been pulled from a list of over two hundred. Some are being attacked directly through research within OCDM and cooperating Federal agencies and through contractual research in universities and institutes. Some of the tougher ones are to be thrown into seminars composed of around twenty business executive reservists, economists, and political and physical scientists, who do not care what the government thinks or to what political compromises it has had to submit, and who are interested only in how to crack a problem. A pioneering session of this type was held recently under the auspices of the Brookings Institution.

Alternative Ways of Averting Nuclear Attack

All this discussion of the results to be expected from a nuclear attack is very grim. It is properly so, because we merely disarm ourselves mentally as well as physically by refusing to talk about consequences that are plainly inherent in our own $40 billion *per annum* investment in engines of massive destruction. Having looked at horror, it is now permissible to weigh the possibilities of averting it.

Perhaps the most reasonably grounded hope of all is that with mutual capabilities of destruction being what they are, no one or no one country rationally would start a major nuclear war. The reservation here, as suggested above, is that the larger the number of nations in possession of the bomb—especially when a Red China still in the angry stage of revolution is included—the greater the chance of someone acting irrationally. Still, this view of the problem may provide time for events to come up with a way of dispelling the nightmarish specter of nuclear warfare.

One such way might be found by making our homeland relatively unattractive as a target. Theoretically, one might mount all of our offensive and defensive power on islands, on Polaris-type submarines, on nuclear-powered aircraft with similar staying powers, and ultimately in outer space. That would be a way of taking the battles back to the battlefields.

Something old and something new is involved in this type of strategy. Military stalemates were once occasionally resolved by a duel of champions. More practically, the historic mission of armed forces has been to destroy the effectiveness of the enemy. But in this century, military strength has come to rest so completely on the industrial capacity of adversaries that the latter has been promoted from a merely important to a prime target, hence the systematic bombing of enemy homelands in World War II.

Now, however, the frightful power of nuclear weapons has, at least to a large degree, turned strategy back to one of resolving the outcome with original equipment. To such degree, forces in being become the champions of the nations, and in one way or an-

other, their destruction could go a long way toward ending matters. If they were placed largely outside of homelands, the latter might again become secondary targets and, probably, fatally vulnerable to the winner of an initial military advantage. There would still be no absolutes, and indeed, one concept of nuclear war contemplates a broken-back situation in which the striking power of both major adversaries is largely demolished and ultimate victory would ride on respective recuperative powers. Even so, under the dispersion concept, industrial and urban centers would continue to be targets but would perforce become secondary. In humanitarian terms, the gain would be so enormous that there is some effort toward pushing strategy in that direction.

Amidst all the controversies over defense, there is a core of agreement that even if a friendless America could survive, it could not remain democratic. Through all divisions, the Congress has provided funds for defense support (a euphemism for economic aid to small nations directly dependent upon us for survival, such as Turkey, South Korea, and South Viet Nam), and for direct economic aid initially to Europe and now on an open-end basis to underdeveloped countries. This is one policy that Russia has paid us the compliment of imitating.

We can buy no friendship or even allegiance to ourselves in this way. The stake is the far more useful one of helping to build such nations into integral economies and societies that no longer need to consider submission to Communist rule as an alternative way of life. Excessive nationalism, preoccupation with industrial growth, and archaic social structures are formidable stumbling blocks, making our task one of crudely adapting, rather than imposing, our own best values, but it is a prime task in the sense that there can never be security for the United States in an unhealthy world. Both government economizers and isolationists can draw some comfort from the fact that any possible cost would be far less than that of a few of our political wastes over which we merely grumble but could reduce if we really cared enough.

All this too is a part of non-military defense. There is no need, and it would be wasteful, for OCDM to move functionally into a field already overcrowded with international agencies. Through OCDM's necessarily close contacts with state and local governments, however, it could bring home the inseparability of the domestic and foreign elements of non-military defense and help to unite them in practice.

Conclusion

The CED was correct enough in determining that "we can afford what we have to afford." Another good generalization underlying that one might be that we are far from exhausting our means of diverting resources to defense without basically injuring our system. We might have to make do with present luxuries or to lose a few, although allocation to defense of some unpledged portion of our annual growth increment alone would add more billions to the defense budget. The amusing idea of excising political wastes from the budget is available as a last resort.

Within the limited context of this story, there seem to be two main problems. One is that there is no clear stopping point to defense spending. Technically, we ought to cut it off at the point where the usefulness of additional capacity to destroy or protect falls off sharply in the sense of Admiral Burke's criticism of the "overkill"; conversely the cut-off point should come where costs begin to mount out of all proportion to probable benefits, as in the case of heavy production of all new weapons at an early stage of development. The calculated risk, either military or economic, will always be there, and there are no absolutes.

The other difficulty is in maintaining a sense of proportion. There doesn't seem to

be much point in sending agents of enormous destruction winging over the ocean when there is no society left behind them. Maximum physical insulation through interception of enemy missiles is, of course, the first line of defense, but it will always be imperfect, and the scale of useful investment in insulating apparatus belongs in the first problem. The means of preserving the rudiments of a nation and rebuilding around them amidst ruin is not an important money problem at all. It is one of deciding to do our best and of recruiting the brains of the country in figuring out how it should be done. Some standby equipment and machinery would be needed, but it could be obsolete for this primitive purpose. Shelters to keep people in existence would cost more, perhaps between 5 percent and 10 percent of the cost of the military complement. We could buy protection from radioactive fallout, the biggest threat, for less. Our principal need, however, is to imagine our way through the horror of an atomic attack as best we can, and to be as ready as possible to apply all of our physical and social skills to the task of rebuilding.

The task is new, just as most of the tasks in our rapidly moving history have been new, and the first requirement for it is perspective. There cannot be much difference between readiness to retaliate and readiness to receive attack as evidence of our determination to meet aggression head-on. It is almost irrelevant to principle that a practicable degree of protection costs a small fraction of retaliation. It is very relevant that protection is of the same order of value as a deterrent and makes ability to retaliate more convincing. This does not mean that delay in shelter construction—the costliest element of non-military defense, particularly if blast protection is included—has not had some justification. The strides now being made by science in perfecting shelter design promise to be significant. It is rather important, however, to keep such delay properly classified in our minds as a calculated risk.

And we must make the most of other chances of averting nuclear attack. One is the fading likelihood of near-term assault while the present equilibrium of terror holds—as long as nothing real or imaginary occurs to jar it and no one in power acts irrationally. Another means of averting attack is by deploying our atomic striking power through the wastes of water and space. A third is to help bring economic and social health to the still struggling portion of the free world, and thereby isolate the Kremlin in a very striking way: Most European satellites are kept Communistic (in the Russian version) only by the proximity of Russian arms, and Red China and Russia are potential menaces to each other.

How To Forecast Defense Expenditures

GEORGE A. STEINER

Here is a step-by-step method which anyone can use to make long-range projections of a vital segment of the Federal Budget.

There is an old story, with different versions, about the traveler who in a long distant age was caught in hostile territory. The Emperor of the land sentenced him to die. Naturally dismayed, but quick-witted, he said: "Oh mighty Emperor, if you delay my sentence for one year, I shall make your favorite horse talk." "Granted," replied the Emperor, "but if you do not succeed in making my horse talk at the end of one year, you shall be boiled in oil." One of the jailers asked: "Why did you make such a preposterous promise. At the end of the year, you surely will die most horribly." "Well," said the traveler, "during the year, the Emperor may die, I may die, the horse may die, and who knows, maybe the horse really will learn to talk."

Forecasting national defense expenditures is subject to uncertainties of equal magnitude. But despite the uncertainties, some forecasting has been reasonably accurate, has been put to good use, and can be explained in terms of methodology.

In this article, I will explore the basic reasons why forecasts of defense expenditures are of great value; the range of difficulties standing in the way of one intrepid enough to make a forecast; some of the methods by which a forecast can be made; a preferred method; and what management ought and ought not to expect from such forecasts.

It should be noted at the outset that although the central focus of the paper is the projection of long-range defense expenditures, the methodology used to accomplish this type of projection necessarily covers all Federal expenditures. The Federal administrative budget categories are used as basic frameworks in such projections.

Why Try to Forecast Defense Expenditures?

Economic forecasting takes a special type of courage. Long-range forecasting of military expenditures takes a peculiar fortitude. So immeasurable are the uncertainties, and so determining are they on outcome, that minor miscalculations about a few uncertainties are capable of creating extraordinary errors in final conclusions. For example, a relatively minor error concerning probability of war or disarmament will have an overwhelming effect on expenditure totals.

A time-span of ten years is not unusual for a long-range forecast of defense expenditures. Projections are sometimes attempted for even longer periods. In 1950, few could imagine an annual defense budget over $15 billion. Yet almost overnight, the level rose above $50 billion. Following the Korean War, how many people anticipated a continuing high level of military expenditures? Ten years ago, who correctly anticipated the major product mixes of today's defense spending? In fiscal year 1950, defense spending was less than 5 percent of Gross National Product. Today it is almost twice that percentage. The range has varied in the past from less than 1 percent to well over 40 percent. Particular items in the defense budget, of course, have moved even more volatilely. Fluctuations of over-all budgetary categories, and relationships with GNP, are shown in Table I.

TABLE I

GROSS NATIONAL PRODUCT AND FEDERAL EXPENDITURES, 1947–1961
(IN 1959 PRICES)
(BILLIONS OF DOLLARS)

Year	Gross[1] national product	Federal expenditures[2]				Non-defense as percent of GNP	National security as percent of GNP
		Total	Non-defense[3]	National security	Department of defense		
1947	315.7	58.4	36.7	21.7	19.8	11.6	6.9
1948	327.2	47.4	30.8	16.6	15.3	9.4	5.1
1949	328.2	54.3	36.6	17.7	15.8	11.2	5.4
1950	356.2	53.5	35.9	17.6	15.8	10.1	4.9
1951	385.0	54.0	26.7	27.3	24.1	6.9	7.1
1952	399.0	79.8	26.1	53.7	47.4	6.5	13.5
1953	417.1	91.0	29.2	61.8	53.4	7.0	14.8
1954	408.8	82.1	25.3	56.8	48.8	6.2	13.9
1955	441.5	75.1	27.9	47.2	41.3	6.3	10.7
1956	450.9	73.3	28.5	44.8	39.5	6.3	9.9
1957	458.9	73.1	27.7	45.4	40.3	6.0	9.9
1958	448.6	73.7	28.5	45.2	40.1	6.4	10.1
1959	478.8	80.7	34.3	46.4	41.2	7.2	9.7
1960	498.0E[4]	78.3E[5]	32.6E[5]	45.7E[5]	40.9E[5]	6.6	9.2
1961	519.0E[4]	79.8E[5]	34.2E[5]	45.6E[5]	41.0E[5]	6.6	8.8

[1] *Economic Report of the President*, Jan. 20, 1960, U. S. Printing Office, Washington, D.C., 1960.
[2] *Federal Budget*, U. S. Government Printing Office, Washington, D.C. (various dates).
[3] Total Expenditures less National Security.
[4] Author estimates.
[5] *Federal Budget*, fiscal year ending July 1961.

In light of such experience, and particular problems to be noted shortly, why would anyone in his right mind try to forecast defense expenditures?

To begin with, a projection of Federal expenditures over a long period of time is an indispensable tool for many varieties of company planning. If military sales are important, such forecasts are an indispensable frame of reference for company long-range planning. If a projection, for example, is translated into a share of the military market which declines or grows very slowly, a problem of high priority faces the company. A forecast that highlights such a problem long before it arises is of much value. Basic trends developed in a defense-expenditure forecast are foundations for planning products, research and development, personnel, finances, manufacturing facilities, equipment replacement, and sales. Clearly, if company planning activity is not based on some reasonable estimate of the future, there is either no planning, which is a first-class ticket to failure, or the planning is done in blind ignorance of basic premises, which may be equally unwise.

For business managers, economists, and others interested in the activity of the entire American economy, knowledge of the likely size and projected trends of military expenditures is recognized as being particularly significant. Both the increase and decrease of these expenditures have profound implications for economic activity in general, for particular regions, and for individual industries and companies. But dollar flows are insufficient measures of the full range of economic influence. Military expenditures, for example, affect importantly basic research and development of new products, peacetime applications of military technology,

government-business relationships, and taxation to support defense. Economists have been somewhat slow to recognize the real significance of "defense economics," but the gap is now being filled.

Projection of Federal expenditure trends should be of major interest to many people in and out of government who are concerned with public policies affected by and influencing the budget. Long-range plans for tax policy; non-defense expenditures of all types; economic and political repercussions, and interrelationships between Federal, State and local financial affairs are among policy areas where Federal expenditures have major determining roles.[1]

However, long-range forecasts of military expenditures can be rather valuable in developing trends which in turn bear upon company, general economic, or governmental problems. Samuel Cohn, a sharp critic of long-range Federal budget forecasting, says, "Long-range projections which are done carefully, and which are checked against the available knowledge about individual Federal programs, can be good indicators of general trends over time."[2] It needs to be pointed out, however, that a long-range projection of military spending cannot be used in 1960 to tell a user exactly what budget and product mix should be expected in 1965. As Otto Eckstein points out: "The hazard of projections is not that they will be wrong, but that they will be accepted literally—then an illusion of knowledge will take the place of keen awareness of ignorance. Watchfulness and flexibility may be impaired. And, if the projections are systematically in error on a grand scale, they may do more harm than good."[3]

[1] See *Federal Expenditure Policy for Economic Growth and Stability*, Joint Economic Committee, 85th Congress, 1st Session, November 5, 1957, especially papers concerned with national security expenditures by Arthur E. Burns, Leo Fishman, George H. Hildebrand, David Novick, and Arthur Smithies, pp. 507–559.

[2] Samuel M. Cohn, "Problems in Estimating Federal Government Expenditures," *Journal of the American Statistical Association*, December 1959, p. 719.

[3] Otto Eckstein, *Trends in Public Expenditures in the Next Decade*, Committee for Economic Development, New York, 1959, p. 2.

If the forecasts are well made, and put to uses for which they are fitted, they can be of high value. While the art of forecasting military spending is in its infancy, some progress has been made recently in methodology, availability of data, and application. I have seen and participated in making forecasts of military expenditures which have turned out surprisingly well. Nevertheless, the risks are ever fresh and dangerous for each new attempt.

Some Problems in Forecasting the Defense Budget

Among the serious problems confronting anyone who attempts to forecast national security expenditures, the following stand out:

First, there is no generally acceptable theory or explanation of how the defense budget is determined. This may seem a strange statement. But what is meant is that no general body of analysis exists by means of which one can cut through the maze of forces operating on the defense budget to find a ready explanation of why the expenditure level is what it is at any time and over any period of time. In contrast, there are many theories about economic behavior. Out of these theories, some rather practical and tested methods of forecasting economic activity have been devised. If comparable theories existed in the area under discussion it would be considerably easier to devise appropriate methods and techniques with which to make forecasts.

The aggregate levels of defense budgets are developed within a unique intermeshing and concentration of broad, complex, and powerful political, economic, military, technical, social, and purely administrative-type pressures on the defense budget.[4]

These pressures take place in a pattern of bargaining, or negotiation, at different levels of government. The process is one of bargain-

[4] See Arthur Smithies, *The Budgetary Process in the United States* (New York: McGraw-Hill Book Company, Inc., 1955).

ing among the Services and between the Services and the Office of the Secretary of Defense, between the Secretary of Defense and the Executive Office of the President, and between the Executive and the Legislative Branches of Government. In this process, informal liaison between the individual Services and the various levels of Government creates a more sporting and uncertain bargaining outcome. Untangling and weighting such pressures is most difficult.

The Influence of Rapid Change

A second series of problems surrounds the rapid technological, military, and strategic changes which continuously influence the defense budget. There have been few, if any, periods in the history of the world when weapons technology has undergone swifter change than today. The pace will accelerate in the future. This change results in altering military strategies and tactics, and in turn, defense program requirements, costs and expenditures. Technological change is not confined to the U. S. Our technical advances influence the direction and degree of efforts of the Soviet Union. In turn, their technical progress influences what we do. Our superiority in the manned bomber field, for example, was reported to be important in a decision of the U.S.S.R. to concentrate on missiles. The first Russian Sputnik, which resulted from this effort, also began a new and significant chain of events in the United States which has, is, and will continue to influence our educational, technical, military, research, administrative, and budgetary activities. The rapidity and potential significance of technical weapons developments make defense-expenditure forecasting hazardous because of difficulty in foreseeing them.

Availability of Data

A third area of difficulty concerns availability, adequacy, and accuracy of basic data. The most available and, theoretically, the most useful body of data forming a basis for projecting future trends is the Federal budget itself. But this document has a number of major shortcomings. David Novick has pointed out, for example, that "With some few exceptions, the present budget does not serve as a very definitive indicator of governmental intentions or the implications of intentions."[5] The budget is not end-product or objective oriented. Rather, it is Department oriented. The individual Service budgets are divided into major functional groups, such as, maintenance, fuel, personnel, procurement, and construction. One will look in vain for budget categories which permit aggregation of expenditures for programs dealing with major national security objectives, such as deterrence, protection of Allies, limited war capability, or warning measures. The budget does not reflect, therefore, the tasks or missions which add up to the basic objectives and plans of the Department of Defense. No one can accurately aggregate data from the Federal budget to determine what has been spent on particular missions, objectives, or plans, either in terms of end-products or supporting programs. As a result, it is impossible to develop a firm base of past data on which to make projections in terms of meaningful policy objectives.

There are also other problems involved in forecasting from the budget. For one thing, the budget is filled with enough technical jargon to delight the most fastidious student of officialdom's obscure verbiage. Perhaps more important, each budget covers a limited time-span. Budgets reflect short-term rather than long-term decisions. Indeed, the budget does not extend beyond one future fiscal year. Since the life cycles of different weapons systems vary so much in time and magnitude, the problem of the forecaster in building up future potential costs of presently authorized programs is virtually

[5] David Novick, "The Federal Budget as an Indicator of Government Intentions and the Implications of Intentions," The RAND Corporation, Santa Monica, Cal., P-1803, October 1, 1959.

impossible without data not found in the budget. A final shortcoming, and a trying one, is the change in budget classifications. The current FY 1961 budget adopts new groupings. So far as I know, no historical data for these new classifications are available.

While I realize that the Federal budget is not designed as a tool for those interested in projecting the military budget—and I can see acceptable reasons why an effort may be made to make this task doubly difficult—a part of the problem of the analyst does lie in the deficiencies of the Federal budget when attempts are made to use it for this purpose.

Security Problems

A final difficulty concerns security problems involved in acquiring and examining data relevant to a defense-budget forecast. I merely point out this problem, not express an opinion about its cause. Some types of data are available in great abundance, as for example, types of airplanes and missiles now being produced. Other types of data are exceedingly scarce, as for example, follow-on series for existing weapons systems, or costs of future weapons systems. Classified data can hardly be made available to anyone interested in trying to play the entertaining game of "forecast the military budget." Whatever the security clearance of the forecaster, problems in finding useful data do exist.

To these special-type problems, one must, of course, add the usual problems of forecasting of this type. These problems are well set forth in standard treatments of economic forecasting.[6]

In sum, a forecaster of the defense budget is faced with a subject where uncertainties are deep and widespread in the area of study, where experience underscores a high potential volatility, and where judgment must assume major responsibility in forecasting. The longer the period of time covered, the more difficult are these problems.

What Are the Main Approaches to Forecasting the Budget?

The sport of projecting the military budget for any length of time is relatively new. A number of approaches are available from which seven will be discussed here.

First is the "Mickey Finn" approach. This technique simply projects the current situation into the future. There are a number of ways to do this. One is to assume that the current situation will continue without change. This may mean the absolute dollar qualities may be continued or the trend of the past will be continued. Either of these methods is too naive for futher consideration.

An important variation of this approach is multiple correlation analysis. Here the possibilities are many. One method is to correlate the total Federal budget with GNP and project the total budget by correlating it with GNP forecasts. Then, the defense budget is correlated with the total budget and a projection is made. Models can be made more sophisticated than this one, of course, but the principle is the same.

All these methods assume that past relationships will continue in the future; cause and effect will be identical; and although uncertainty may exist, there will be none in quantum relationships. These assumptions are absurd.

"Blindman's Buff"

Second is "Blindman's Buff." This is the method of finding out what the customers say they will need and get in the future. The customers, of course, are the individual Services.

What customers think they will get may be based on wishful thinking or careful planning. It is not always easy to distinguish between the two. In all cases, the forecaster should be aware of several considerations. First, any long-range projection is no better

[6] An excellent treatment is V. Lewis Bassie, *Economic Forecasting* (New York: McGraw-Hill Book Company, Inc., 1958).

than the assumptions on which it is based. So these assumptions must be examined carefully. Second, there are projections to build up costs of continuing present programs. These projections are statistical series for decision-making. They are neither forecasts of probable expenditures nor requirements. Finally, some announcements or discussions of future needs by officials may be for tactical political purposes. Altogether, customer intentions, as best they may be described by the customer, are useful ingredients in the analysis of a forecaster. They are not reliable forecasts.

"Shopping List Tally"

A third approach is the "Shopping List Tally." This approach rests on the premise that there are certain essential military requirements which need to be met irrespective of cost. One simply finds the costs for these requirements and totals them. There are many difficulties with this approach. To begin with, over a long period of time, alternative choices exist about how our basic security objectives may be met best. These will have different price tags, will reflect changing strategies of our opponents, and will be subject to various values. In addition, program-requirements analysis for any period ahead is confronted with problems of blurred vision. With limited perspective, there may be a built-in downward bias in this approach. Finally, this approach tends to ignore other pressures focused on the budgetary process.[7]

The "Tranquilizer"

I call the fourth approach "Tranquilizer." This looks at the problem in terms of Federal resources available to meet defense needs. An implicit assumption is that defense needs are almost insatiable, that no priority for funds is greater than for national survival, and that once basic needs are met from tax yields, the residue should be available for defense. There are some useful calculations of how much defense the United States can afford.[8] Some of these surveys have shown clearly that if there were a justifiable need, the defense budget could be substantially higher than it is today without seriously affecting the living standards of the people of the United States. However, to forecast that any calculated difference between revenue and legitimate non-defense needs should be spent for defense is not wise.

"Pin the Tail on the Donkey"

A fifth approach is "Pin the Tail on the Donkey." It begins with the realistic assumption that certain forces are dominant in the determination of level and composition of the defense budget. This approach becomes unrealistic when an assumption is made that isolation and study of a few major determinants will yield a ready projection. It is dangerous to assume that the same influences will have the same impact on the military budget over an extended period of time. For example, financial considerations appear to have had a most important influence on the present budget. This influence may not be as great in the future.

The "Opinion Poll"

A sixth approach is the "Opinion Poll." A poll of opinion among selected "influence centers," "opinion leaders," or "experts" is relied upon in this approach to produce a reasonable projection. The use of this method for this problem has the same shortcomings as its use in developing a general economic forecast. Opinions vary a great deal. It is difficult to weigh them one against another. And, "experts" can be wrong. The likelihood of doing better among non-experts is, of course, much less.

[7] Henry Rowen, *National Security and the American Economy in the 1960's*, Study Paper No. 18, Joint Economic Committee, 86th Congress, 2nd Session, Washington, D. C., 1960. See pp. 64–65 for a succinct critical analysis of this approach. See also Alain Enthoven and Henry Rowen, *Defense Planning and Organization*, P-1640, The RAND Corporation, Santa Monica, California, Revised July, 1959, pp. 11–14.

[8] Manuel L. Helzner, "Impact of More Defense Dollars," *Harvard Business Review*, Vol. 38, No. 2, 1960.

The final approach is the eclectic approach. This is a combination of many of the above methods plus a theory and selection of techniques which promise to yield better results than any of the above methods when used alone.

The Eclectic Approach

One of the major difficulties with using any one of the above approaches is that they all fail to reflect the world of reality in which the military budget is developed. The size and composition of the military budget is determined within the budgetary process. This process is a vortex for competing pressures from the military agencies of government and their friends; the individual non-defense agencies of government and their friends; the groups representing taxpayers; officials representing financial interests of the government; and the attitudes among those who must make budgetary decisions. The President and the Bureau of the Budget more or less reflect, and more or less react to, these pressures. Once the budget is settled in the Executive Branch, the play moves to the other end of Pennsylvania Avenue, where the actors take on slightly different roles but nonetheless enter into the bargaining process. Once the Congress acts, one would think the play would end for at least the current fiscal year. But this is not so. Bargaining continues among the major groups involved in the budget, although usually on a much less intense scale.

In this light, the defense sector of the budget may be considered as resulting from bargaining at the margins. Very simply, this means that, conceptually, there is a hard core of non-defense and military spending which is required at any budget period. It is not necessary to know precisely what the dollar figure for each period is. What remains between the level of anticipated revenue and this hard core is available for increasing expenditures in the non-defense or military sectors, for tax reductions, or for all three. Or perhaps a deficit may be accepted. Precisely what eventually takes place depends upon the pressures that are brought to bear in this bargaining process. The most effective pressures are usually those which grow from basic underlying forces discernible to the average individual. This theory is applicable in peace, semi-peace, or conventional-type war.

An effort to make a projection of the military budget in light of this theory, therefore, necessitates the use of some parts of most of the above approaches. One practitioner described his approach this way: "It rests on an unpatented blend of statistical data, historical relationships, heroic assumptions, and a sufficient mixture of past boners and good guesses usually referred to as experience."[9]

In a sweeping general sense, the approach is to develop over-all projections of economic, political, military, technical, and social forces which influence the defense budget over the period of the forecast and estimate within these aggregate trends of defense allocations. Then, projections in each budget area are built-up in as much detail as possible. The totals are built up by estimates of program needs and what they may be allocated. The two estimates—the aggregate and the detailed—are then matched. If the fit is not close, reviews and re-evaluations produce the final projections.

Making the forecast is a hard research project. All the available tools of analysis should be used where the cost is less than the value. Important, of course, is the collecing of available information. Various statistical techniques are helpful in analysing and using this data. Individual experts are of outstanding importance as sources of information and value judgments. Throughout the research, interviews with experts constitute a continuous evaluation process of the highest importance. The various techniques used in building up data and information are, at

[9] Murray L. Weidenbaum, "Trend of the Military Market," *The Financial Analysts Journal*, January-February 1960, p. 3.

best, aids to judgment. There is nothing quantitatively automatic that can produce an acceptable budget forecast. The resulting forecast, therefore, is a mass of judgments about future probabilities as they relate to the defense budget. The more expert knowledge is focused on the accumulated data, the more valid is the final judgment likely to be.

The whole methodology probably is best explained by the step-by-step description which follows.

Basic Steps to a Long-Range Forecast

First, there should be a plan of the undertaking. As noted above, this is a difficult research project, and to do the job well may require important expenditure of time and resources. For this reason, a work specification or a plan of study is useful.

Second, basic assumptions should be prepared. The factors to be considered in making a defense-budget forecast are so numerous that some simplification is needed. One method is to set basic ground rules, or premises, upon which all analysis will proceed. For instance, I think it is wise to make a basic projection first in terms of what one might call a "probable" trend. This is the future trend considered most likely at the time the forecast is made. But there is always the possibility that the cold war may become hot or that it may thaw with disarmament moves. It is useful to deal with probabilities of such events and their implications on the budget. But they are better treated in a separate analysis, unless a very high probability attaches to them. "High," "low," or other probabilities may be developed after the basic projection is made. Then, too, certain purely household assumptions need be made to assure as much consistency in the data as possible. In this light, basic assumptions such as the following may be discussed and developed as a point of departure: no shooting war, no substantial disarmament, continuation of present U. S. foreign policy and major objectives, no severe economic depression, continued strong technological competition between the U.S.S.R. and the U.S., and all data for the future should be in constant current-year prices. Of course, it may be useful to set forth other assumptions, such as continuing improvement in missile guidance systems. But this is a matter of choice. Assumptions may be so important or encompassing as to cover much of the study, or they may be related principally to one part of the study. If the latter, they should be located in the material of that sector and not included as an over-all assumption at this stage. It should not be inferred that such assumptions are settled easily. A basic research job may be required before one of the assumptions is accepted—disarmament for instance.

Third, is an examination of the major environmental determinants of the defense budget. One of the principal problems of the analyst is to select which among the potentially powerful influences working in the following areas merit how much study: political, economic, military, technical, social, psychological, administrative. Forces in these areas will have most to do with the trend of defense expenditures.

Developing a useful frame of reference in this complex area demands some continuous study and consultation with experts. The analyst must try to isolate the strategic determinants to reduce the job to manageable proportions. The great German war theoretician, Clausewitz, wrote: "There is, upon the whole, nothing more important in life than to find out the right point of view from which things should be looked at and judged of, and then to keep to the point, for we can only apprehend the mass of events in the unity from one standpoint, and it is only the keeping to one point of view that guards us from inconsistency."[10] A great American management theoretician, Chester Barnard, says that: "The analysis required for decisions is,

[10] In Byron Dexter, "Clausewitz and Soviet Strategy," *Foreign Affairs*, October, 1950, pp. 49–50.

in effect, a search for the 'strategic factors.' "[11] Drucker speaks of the "critical factor," and others use different phraseology to identify the same idea.

There is no question about the fact that the evolution of the East-West conflict is the major force determining the size and composition of the defense budget. As a consequence, therefore, serious and penetrating analysis of this environmental area must precede, accompany, and follow any procedure for forecasting the defense budget. But what strategic factors should one examine?

Identify National-Security Objectives

Certainly, basic national-security objectives should be identified. It is clearly outside the scope of this paper to try to define such objectives. But, to illustrate, it may be said our basic policy is to assure a world environment in which there will be opportunity for free political and economic growth, in peace, even though choices made by different peoples may vary. Basic in our conflict with the Soviet Union is their desire to implant a solution for the world, "made in Russia," and under Soviet control.[12]

A number of major military objectives have been hammered out. Basically, they are: to deter direct nuclear attack on the United States; if deterrence fails, to limit damage on this country and to obtain the most favorable war outcome that is possible under the circumstances; to deter aggression against our allies and to defend them if deterrence fails; and to aid in the defense of our allies and the free world.[13]

An important problem relates to an examination of strategic events which may directly influence the U. S. conception of what is required to achieve these basic objectives. Clearly, answers to such questions as the following will be important in such an analysis: Is the future one of protracted conflict or one of basic improvement in international relations with consequent reductions in military expenditure?[14] Is the U.S.S.R. likely to de-emphasize military aggressiveness in favor of intensified economic competition? Will current concepts of deterrence of nuclear war prevail, or will the U. S. begin to develop stronger forces to deter or win peripheral wars? Each question such as these must be broken down into more detailed questions.

Similarly, in other areas the pertinent evolving issues, events, and reactions to events must be selected for study. Weapon technological development is a major contributor to change in weapons expenditures. Today's world is one in which new weapons can and do make obsolete many weapons which were themselves new in the very recent past. Gunpowder appeared in the 14th century, but it was not until the mid-19th century that it was reasonably well perfected for war purposes. Today, missile developments have made obsolete all but the most advanced concepts of manned aircraft design new in the late 1950's. Some new missile developments are faced with obsolescence created by anti-missile developments. The technical pace is most rapid. This pace affects politics, military strategy and tactics, and patterns of thought, which in turn relate to military expenditures.

Other environmental influences must be isolated and examined. To illustrate, some observers feel that the world will become less stable in the decade of the 1960's because power will become dispersed among more countries of the world. A growing, aggressive and militant China, for example, adds a new dimension to international affairs. The successful acquisition of nuclear capability by more countries clearly will create new inter-

[11] Chester I. Barnard, *The Functions of the Executive*, (Cambridge: Harvard University Press, 1954), p. 202.

[12] For a fuller treatment see *United States Foreign Policy—USSR and Eastern Europe*, A Study Prepared at the Request of the Committee of Foreign Relations, U.S. Senate, by A Columbia-Harvard Research Group, Committee on Foreign Relations, U.S. Senate, 86th Congress, 2nd Session, Washington, D.C., 1960.

[13] See Henry Rowen, Note 7, p. 8.

[14] Robert Strausz-Hupe, William R. Kintner, James E. Dougherty, and Alvin J. Cottrell, *Protracted Conflict*, (New York: Harper & Bros., 1959). See also *Spectrum of Conflict, 1960–1970, SRI Journal*, Fourth Quarter, 1959, Vol. 3.

national problems. Possible administrative changes, such as Service reorganization in the Pentagon, or new budget powers acquired by the Secretary of Defense will have a bearing upon military expenditure levels. Even the way in which people think traditionally about military, diplomatic and international issues have an influence. Economic and financial affairs are, of course, important. In mind here are issues concerning the economic interests of the United States and what may happen to these interests, which in turn may influence military affairs. Evolving pressures for tax reduction, inflation or deflation dangers, or debt-level changes may have significant influences on expenditure trends.

These are but a few of the kinds of trends which must be examined. All cannot be studied. Once having come to a judgment about broad basic trends which the forecaster chooses as likely to have the most profound impact on the military expenditures programs, he is faced with the task of trying to evaluate their force on defense programs and dollar requirements. The basic defense objectives, for example, cannot be easily translated into military weapons systems or dollar requirements. Future technical changes are extremely fuzzy today. Any effort to translate with precision conceptual alterations in basic trends—the East-West conflict, for example—is bound to fail. But the underlying assumption in this step is that individual study and expert opinion can produce basic trends which in turn will determine the general movement of defense expenditures. It is assumed, too, that this can be done with sufficient foresight to make the effort worth while for the types of uses noted early in this study.

Fourth is a projection of the economic framework within which budget-making takes place. This is a problem of roughing out the broad aggregates of resources available for budget allocations. A GNP forecast should be made. Revenue estimates should be calculated on the basis of this forecast and other considerations. Methods for making GNP projections are generally known and a variety of methods are available for making revenue estimates. In either case, the analyst must make a decision about the penetration with which either estimate is made or whether to accept calculations made by others. Many economic considerations have a bearing upon the budget process—possibilities of recession, inflation, the health of the agricultural economy, and other factors—but the GNP and revenue projections take most of these into consideration.

Non-Defense Expenditures

Fifth is an examination of non-defense expenditures. The problem here is to develop a measure of the pressures for rising expenditures in this area. The best method is to take each important non-defense budget category and study it with a view to predicting its likely level. Interest charges, for example, can be estimated by making assumptions concerning the aggregate level of debt and the average interest charge. Past relationships between debt and average interest can be found and applied to future estimates. The dollar estimates, of course, depend upon views about capital stringency, Congressional action, and deficit financing needs. Otto Eckstein describes for each important budget category in his study (noted previously) what I am trying to say here.[15] Here again, some determination has to be made about the depth of analysis. Enough detail ought to be examined to prevent unusual or important surprises in the derived aggregate non-defense budgetary numbers. The non-defense sector of the budget runs from 50 to 60 percent of the total budget, and the forces seeking to raise expenditures in this area are widespread and influential. A good "feel" for trends in this area is, therefore, of importance in preparing a useful projection of the defense budget.

Naturally, the starting point for these stud-

[15] See Note 3.

ies is today, taking into account what has happened up to the present. The Federal budget is the best source for expenditure numbers. A good bit of information is made available by the individual Departments of government about their future programs. Beyond this material, it is advisable for those engaged in forecasting to maintain a file of selected books, pamphlets and magazines, including hearings before the Congress, and newspaper clippings. The basic problem of the forecaster in this step is not scarcity of data but ingenuity in isolating for concentrated evaluation the strategic determinants of major program trends.

Sixth, some preliminary judgments about over-all allocations of resources may now be made. This is a matter of taking estimated revenues and determining, on the basis of underlying forces which are examined in steps two through five, what dollar amounts are likely to be consumed in non-defense programs, defense programs, tax reduction, or deficits, over the period of time surveyed. The results are clearly matters of judgment based upon examination of fundamental underlying considerations.

It may be helpful to develop different mechanical levels of defense expenditures as a test of the resulting aggregate. For example, what pressures are exerted on the budget if defense expenditures remain at their present relationship to GNP, increase their proportion, or reduce the percentage? Such calculations may uncover potential sources of pressure or ease. They also help to develop broad assumptions which may be within the range of probability, and they help to translate these assumptions into aggregate budgetary figures. For example, an economy trend that would hold the defense budget at a lower ratio of GNP than the present approximate 9 percent may be associated with various possible events. These events might include acceptance of a minimum deterrence force policy, various types of arms limitations, and a reduction of specified types of procurement. Similar considerations can be developed for other possible levels, such as a constant defense-dollar level maintaining the percentage of GNP, a moderately rising percentage, or a crisis level of given specifications. Such levels are useful to test the impact of events on programs and programs on expenditure requirements.[16]

Seventh is a systematic and detailed examination of each major budget category in the defense sector. This step is a bottom-up approach. The basic objective is to prepare projections for each important element in each major defense-budget category.

Service budgets are divided into the following type major categories: missiles; aircraft; ships; ground electronics; other procurement; operation and maintenance; military personnel; research, test, and development; military public works; and other miscellaneous categories. Slight differences exist from one Service to another. To get an aggregate budget figure for the Department of Defense, totals for the Services must be added to programs in the Office of the Secretary of Defense. To get national-security aggregates, the following must be added to these figures: Atomic Energy Commission, Military Assistance Programs, and Stockpiling. In addition, programs of the National Aeronautics and Space Administration should be included here because of their bearing upon military space programs. All factors cannot be considered. Nor can the analyst expect to make a detailed accurate projection. The trends, rather than details, should be emphasized. No amount of accuracy in detail will overbalance a miscalculation of major trends.

Each of the military budget categories requires a separate type of analysis. All are more or less influenced by larger environmental influences. So first of all, it is necessary to have a rather good understanding of national-security objectives, basic policies to achieve these objectives, and an estimate of

[16] See, for example, Rowen, Note 7, pp. 77–79.

evolving circumstances within which the policies will be followed and, if need be, altered. This should be made available in steps previously described.

With this background in mind, the work can proceed. The following steps are suggested in projecting "hardware" programs:

A. Establish a list of major programs in the area to be studied. For example, in the USAF aircraft category, each weapon system that exists today, that is anticipated for the near future, and that is possible within the period of the forecast should be set forth. This listing should be reasonably complete.

B. Build as complete a data file on each major program as is possible within the time and resources of the individual or group making the forecast. This task will be easier for the forecaster who can establish a "need to know" basis for using classified documents. Data are available on a "need to know" basis for varying degrees of value to a forecaster.[17] None of the classified publications, however, provides enough information to make a satisfactory projection for a long period of time.

The person who is not privileged to see the various classified documents can, however, find a surprising volume of useful data.[18] Magazines, newspapers, Service publicity handouts, Congressional Hearings, and speeches of public officials continuously make available all sorts of information of value to the forecaster. In recent months, for example, a number of publications have carried detailed analyses concerning the next ten-to-fifteen-year program of the National Aeronautics and Space Administration.[19] Congressional Hearings are a veritable gold mine of information concerning past, present, and anticipated military programs.

C. When sufficient information has been collected, it should be possible, with varying degrees of confidence in the numbers, to make a variety of estimates. These estimates should be approached in much the same way as the entire forecasting job here described. Attention should be given to the environmental factors influencing the program. Basic assumptions and premises should be set forth, examined, and assumed or rejected. Trends should be determined. Estimated numbers by years should be calculated and costed out.

Costing, of course, is an extremely difficult undertaking. Chart I shows why a series of estimates is needed for each major weapons system. In the absence of authoritative calculations, the analyst must do the best he can with whatever information is available. Although difficult, the cost task can be done with sufficient validity for the basic purposes of the analysis.

D. The forecaster then should review the totals to see if they look reasonable in light of various guidelines. As projections extend into the future, for example, the clarity of vision becomes hazier and hazier. Because of the "forecaster's smog," the totals inevitably fall off in the future. The question is whether this makes sense in light of a variety of anticipated forces bearing on the subject under survey. If not, some estimate must be made for unforeseen programs. Chart II is a past projection made by one of the most competent and sophisticated forecasters of the military missiles procurement program

[17] Each of the Military Services, of course, has many classified documents of value to the analyst. All these will not be listed here, but a few illustrations may be helpful. Information concerning Navy aircraft is contained in the Bureau of Aeronautics' *Long-Range Research and Development Plan*, Department of the Navy. This shows when a new aircraft and missile will be introduced, its characteristics, justification, and comparable information. The forecaster, however, must make up his own mind in numbers and costs. Comparable series are available for anti-submarine warfare, amphibious warfare, and other topics. The Bureau of Ships' *Long-Range Plan for Research and Development* contains comparable information for ship and associated programs. Army Ordnance has a series on *Qualitative Development Requirements*, published periodically, dealing with various Army Weapons. The U.S. Air Force also publishes a number of documents having varying degrees of usefulness to the analyst. For example, *Program Guidance*, published by the Deputy Chief of Staff, Plans and Programs, Headquarters, USAF, is concerned with general objectives and descriptions of USAF aims. *Aircraft and Missiles* contains data on types anticipated. All the documents noted here are classified, are published periodically and are available only on a "need-to-know" basis.

[18] See, for example, *Aerospace Marketing Handbook*, Defense Marketing Services, Inc., Los Angeles, 1960.

[19] See, for example, "National Aeronautics and Space Administration Ten-Year," *Western Aviation*, March 1960; and Seabrook Hull, "Space . . . The Key to This Market is NASA," *Missile Design and Development*, January, 1960.

that I know. This Chart resulted from a detailed program-by-program analysis. Yet notice the estimated volume of presently unidentified programs throughout the period under review.

E. An effort should be made to exchange information. If others can be found who are doing the same type of work and are willing to exchange views, a seance with them should be arranged, if for no other reason than to commiserate with one another the fate that led them to their present plight. More importantly, an exchange of ideas with public officials and experts in various walks of life who are competent to comment on strategic parts of the forecast should also be useful. My experience leads me to conclude that this last step is an essential one.

These steps should be followed both by the person having access to classified documents as well as the forecaster who is not privileged to see restricted data. Classified documents neither individually nor collectively contain enough information to make easy the task of building up budget categories on the basis of specific programs. Hence, much additional information generally available must also be collected, sifted, evaluated, and fitted into the puzzle. It is true that the analyst not having classified data has a somewhat more difficult job. But it is also true that he can, with diligence and acumen, catch the underlying and strategic trends so fundamental in this type of exercise.

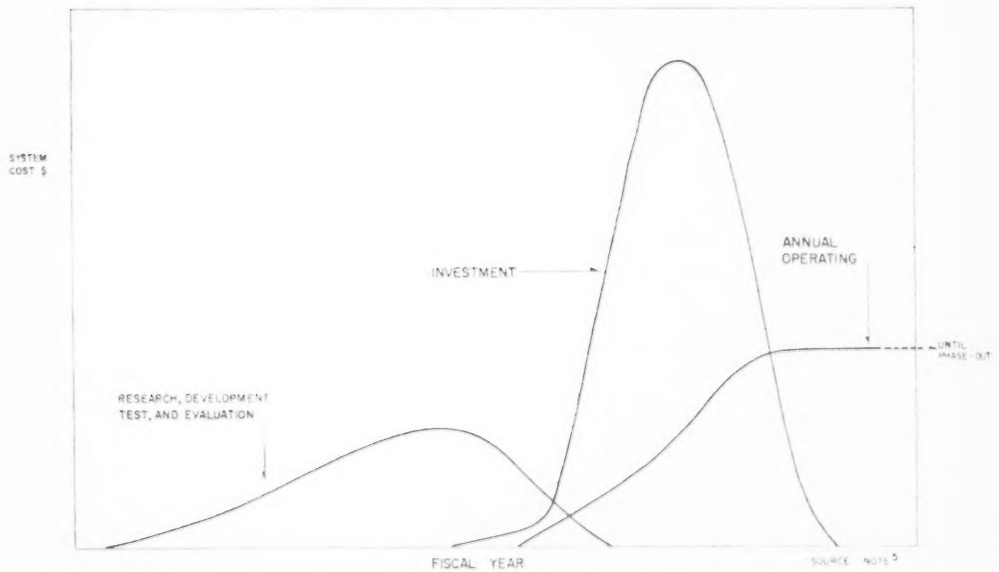
There is no need to go into detail concerning methodology in the bottom-up examination of other budget categories. Each must be examined in turn for strategic programs and basic determinants of trends. Each is a little research project in itself, the scope of which is tailored by the time and resources available for and allocated to the job and by the importance of the category to the total projection and to the purposes of the study.

The eighth step brings together results from the over-all approach (steps two through six) and from the detailed build-up (step seven), and compares the sets of numbers.

Why go through this process of calculating defense expenditures from two points of view? Each serves as a check on the other. In looking at the matter from a broad aggregate point of view, it is easy to become enamored with the broad sweep and to neglect program

CHART I

EXAMPLE OF WEAPON SYSTEM "LIFE CYCLE" FUNDING PATTERN



details. On the other hand, attention concentrated solely on program details may result in additive numbers that clearly are not in tune with broad environmental changes. In addition, the further forecasts are projected out in time, the more difficult it is to see specific program details. An aggregate view is necessary to prevent a projected downward bias in dollar expenditure trends. For a very short time period, more reliance should be placed on the bottom-up methodology; for a longer projection, say ten to fifteen years, more attention should be devoted to the over-all approach. But neither for the short nor the long run projection should either approach be ignored.

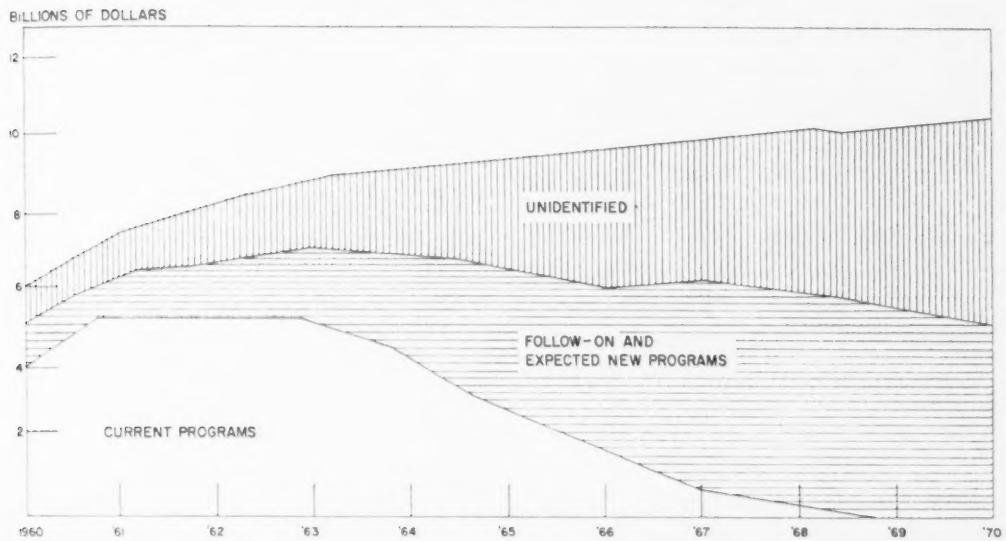
When the two sets of numbers are matched, the opportunity is presented for a rather general review of what has been done and of judgments made up to this point. It is desirable to inject into such discussions as much expert talent as can be gathered—economic, political, military, technical, and administrative. The process is one wherein the most probable trends in underlying environmental factors are re-examined and appraised, military requirements in light of these influences are set forth, and estimates are made of the outcome of the bargaining process for limited resources.

Ninth, a "high" and "low" estimate of selected defense expenditure categories should be made. The purpose here is to provide for the user of the forecast some estimate of probabilities on the high and low side. This is important because of the great uncertainties attached to any "probable" projection. What is meant by "high" and "low" should be clarified by the analysts. But, to illustrate, "high" may refer to the level dictated by a peripheral conflict comparable to the Korean War. "Low" may refer to a level resulting from disarmament of specified characteristics. The point is that these ranges should not be made mechanically once the "probable" has been determined. It is difficult to see how purely mathematical calculations above and below the "probable" can be very helpful. It is the reasoning and probability ranges that lay behind the calculations that are most important to users of projections.

There are two ways to go about developing a high-low estimate. At each step in the process of building up a total Federal budget,

CHART II

ESTIMATED MISSILE AND SPACE EXPENDITURES 1960-1970



three estimates can be made on the basis of varying assumptions in terms of probability meanings attached to "probable," "high" and "low." Thus, for each budget category in the non-defense sector, three estimates may be made: "high," "probable," and "low." When all budget sectors are completed, simple addition will yield the derived numbers. In step six, attention may be focused on the "probable," but with its completion, the "high" and "low" may be appropriately examined.

A better method is to deal with "high" and "low" estimates in aggregate terms. While the forecasting program to obtain the "probable" is proceeding, an effort may be made to choose the strategic determinants of a possible "high" and "low." More attention probably should be attached to the "low," not so much because there may or may not be higher probability expected, but because the occurrence will create more severe problems for decision-makers in the business world. When these major determinants are examined and conclusions reached, an aggregate appraisal roughly translated into budget numbers may be sufficient. But the more possible a "low" appears to be, the more thoroughly it should be measured.

Tenth, the material should be prepared for the consumer. What is done depends much upon each situation. Observations in the next section, however, may provide some useful guides about what to do.

How Defense-Expenditure Forecasts Should Be Used

The biggest users of the type forecast here discussed probably are managements of business enterprises. Because of the importance of such forecasts to planning activities, it is well for managers to have in mind some guiding principles about their use.

First, management should understand clearly the many limitations of defense-expenditure forecasts, particularly if made for a long period of time. There is no infallible method to project Federal expenditure trends and patterns in the aggregate or in particular details. This is especially true for the defense sector. There are far too many important uncertainties and imponderables for sure forecasts. The subject matter is so volatile that a person or group who has made accurate forecasts in the past can suddenly fail.

Second, however, it is possible to develop surprisingly accurate projections of trends. Such projections can serve as major premises in many business planning programs and may help to clarify areas where deeper exploration and study may pay the company high dividends. In mind here are possibilities for research contracts and new products.

Third, the methodology discussed here is far more useful in the development of trends than precision in details, especially for the distant future. Management should not use these forecasts for purposes for which pinpointed, reasonably accurate details are required, unless step seven is extremely detailed. For example, a forecast today, which might well include an estimate that so many X missiles will be ordered in 1968, should not be used as a base for calculating sales goals for that item, or for possible component product sales entering into it, without an understanding and acceptance by those making the forecast that the data are being used in this way. It is possible that the data may be good enough to use in this way. But this may not be the case. The methodology described in this paper is designed more to establish trends and patterns of interrelationships, especially in the distant future, rather than finite program accuracy.

Fourth, management should insist on a clear, brief statement of underlying assumptions upon which the forecast is made. This includes both over-all premises and those associated with each major sector. With such assumptions, management may decide upon those with which it agrees or disagrees and modify the final results accordingly.

Fifth, management should insist on a forecast that is not too qualified. A good way to

avoid error is not to make a forecast—but to qualify. Forecasts are of more value to management when reasonably specific.

Sixth, management is entitled to a forecast that is not changed too often.

Seventh, management has every right to expect that those making the forecast are as objective as possible. Forecasters should give users reason to have faith that biases are held to a minimum.

Eighth, management should know how it wants to use forecasts. This should be known to the forecasters, who should be expected to furnish the information for the purposes intended, provided, of course, it is possible to do so.

Ninth, the work specification for the forecast should be economical, that is, costs should be less than benefits. To follow all the steps outlined here thoroughly and in detail is an expensive undertaking. Management should be sure that the costs are less than values received. It is perhaps more important to keep the need for balancing this equation in mind than to try to make an actual cost-value calculation.

Finally, management should not expect too much. To do this job well is difficult, exacting, and requires many skilled talents. The task should not be given to those unskilled in the methodological and substantive requirements if results are expected to serve as bases for planning and action. When the Lord of Ancient Israel was seeking a withering rebuke to a recreant people, he asked that they be robbed of their capacity to see and to understand. "Make the heart of his people fat," he cried, "and make their ears heavy, and shut their eyes; lest they see with their eyes, and hear with their ears, and understand with their heart, and be healed." From Isaiah to this day, the belief that foresight, insight, and understanding are the godlike gifts has held. These are rare talents.

Communications from Readers...

Profit Renegotiation Reconsidered

From: E. C. Burkhart, President
Genisco, Inc.

Re: "What Is Appropriate Public Policy for Profit Renegotiation," *California Management Review*, Fall, 1959.

I would disagree emphatically with Sumner Marcus regarding his use of one percent of renegotiable sales as a figure representative of costs to industry (see page 47, *CMR* Fall, 1959). I'm quite certain a closer cost figure would be $235 million, or literally dollar for dollar in actual cash, if not more. Then there is a far more damaging factor related to profit renegotiation which cannot be measured in terms of dollars: the eating away of the moral foundations of our free enterprise system. Immeasurable damage is done to the moral and ethical principles of those persons who recognize the utter and total unfairness of a system which takes your gains but will not share your losses, which looks back over a contract after the risks have been taken and penalizes you if you have avoided the hazards.

How can one uphold his respect and support for a system which operates in this manner? What compunction is there to comply if any feasible way presents itself to avoid this net? And then we wonder why our costs on military contracts skyrocket.

I know from conversations with many small and large business operators that hundreds and thousands of industrial management hours are siphoned off in devious ways to avoid the net. I know that wasteful practices are pursued to lower earnings and increase costs so that performance won't become subject to renegotiation. How corrosive can we become?

The profit renegotiation situation is far more vicious than most gentlemen will concede, for at times one must conduct one's self in something short of a gentlemanly manner to avoid a thing far more repugnant than that which years ago created a Boston Tea Party; a thing in which one almost loses one's self-respect with compliance because it negates the principles upon which the country was founded. A sort of jungle law, the survival of the fittest, becomes applicable, and many a very fit concern is doing all right.

So I feel that Mr. Marcus' cost figure of one percent of renegotiable business is way off the actual figure. But as in any *sub-rosa* activity, the cost defies a true measurement.

From: Sumner Marcus
Associate Professor
College of Business Administration
University of Washington

Re: E. C. Burkhart comment

Mr. Burkhart's estimate (above) of $235 million as the direct cost of renegotiation to firms being renegotiated was the figure I meant to use in my original manuscript. Due to an editorial misunderstanding, however, the figure published was $235 thousand. Obviously, if the cost of renegotiation were one percent of the renegotiable sales of all firms subject to renegotiation, the total cost would be far in excess of $235 thousand, since there are single firms which have annual renegotiable sales of close to a billion dollars. Actually, the $235 million estimate was made at the 1958 hearings on the extension of the renegotiation act by the Machinery and Allied Products Institute and assumes a cost of *one tenth of one percent* of renegotiable sales.

Whatever the direct cost of renegotiation may be, I share Mr. Burkhart's fears concerning the intangible effects of renegotiation upon the efficiency and cost of defense production. As I pointed out in my article, renegotiation was adopted in the first instance almost twenty years ago as an avowed

emergency measure to deal with one of the side effects of the great increase in military purchasing which resulted from the war. This side effect was the realization of unanticipated, unreasonable profits by some government suppliers.

At the time renegotiation was adopted, it was believed that a flexible method of profit control, such as renegotiation, would result in greater efficiency than the more rigid controls that were being proposed as alternatives. In practice, renegotiation has not always worked this way. I know that many firms believe that they do not get special consideration for special performance and that the profits they will be permitted to retain by the renegotiation boards are a predetermined but unannounced percentage of their costs or their net worth. To the extent that firms believe they will receive this kind of treatment, there are incentives to increase rather than to reduce costs (as I point out in my article and as Mr. Burkhart suggests in his letter).

Even with recognition given to these important drawbacks to the renegotiation process, it is necessary to determine whether some form of profit control is still needed in 1960. I have attempted in my article to suggest some of the reasons why specific profit controls are probably not as important today as they were in earlier years. If it were concluded that some profit control is still needed, it is possible that there are better ways to accomplish the control than through the traditional renegotiation process.

Would Higher Capital Investment Increase Foreign Productivity?

From: W. D. McEachron
Head, Long-Range Planning Group
Standard Oil Company (Indiana)

Re: "When Should A Company Manufacture Abroad?" Elwood S. Buffa and Alexander E. Bogardy, *California Management Review,* Winter, 1960

The article "When Should A Company Manufacture Abroad?" is most interesting, and raises a number of points that might easily be overlooked by those contemplating foreign operations. The comparison of wage rates in various industries among the several countries quoted is quite useful, as is the total social charges shown as a percent of hourly wages. The portrayal of labor productivity among the various nations is also of value.

However, the use of labor-productivity measures to correct wage rates per worker to a common basis would appear to be quite misleading. As supported by the article itself, the high productivity of the American worker is largely due to the relatively large capital investment behind him. Presumably, the foreign worker could achieve comparable productivity if he also enjoyed the benefits of such heavy investment. When we divide real wage rates by this type of labor productivity, we are in effect presuming that an American company would put much less capital into its foreign operation than it would into an equal-sized operation in this country. The net effect of such an assumption is to make the lower labor cost for foreign operations show up in terms of a lower capital charge.

It would seem more likely, however, that a company considering a manufacturing investment abroad as compared to one in this country would think in terms of plants employing substantially the same set of physical facilities. In this instance, labor productivities would be similar, the real wage rates would apply, and the company would enjoy directly the full benefits of lower labor costs abroad, less any increased cost in fuel and materials.

From: Elwood S. Buffa
Associate Professor of Production Management
University of California, Los Angeles

Re: W. D. McEachron Comments

The crux of the question which Mr. McEachron has raised revolves around the bal-

ance of costs here in the United States and abroad. As we noted, capital, materials, and some other overhead costs are expensive relative to labor in most foreign countries. Therefore, the most economical combination of capital and labor abroad is usually one which involves a smaller capital investment behind each worker with resulting lower productivity. A manufacturer who ignores the higher cost of capital, and capital equipment may find that while his net labor costs are excellent, his capital costs may counterbalance them. The point is, that each case is an individual one, in which the manufacturer must attempt to minimize his combined costs. In most instances, it would be economical to substitute labor for capital in some degree. There are certainly important exceptions to this, and it may well be that the oil-refining business is one. From my meager understanding of oil refining as it exists today, I believe that it is not only economical to use the highly automated plant which has been developed, but that the automatic process controls are *required* in many instances to achieve the close controls needed. Manual control might not be acceptable in many instances. Nevertheless, there is a marginal substitution rate of labor for capital which favors the use of labor somewhat in Europe and in extremely low wage-rate countries. In India, for example, the most economical combination of capital and labor would be quite crude by our standards.

Though there may be many paths about the foot of the mountain,
Yet, when the top is reached, the same moon is seen.

—an anonymous Japanese poet

CALIFORNIA MANAGEMENT REVIEW

Index to Volume II, 1959-1960

INDEX TO TITLES

INDEX TO AUTHORS

No. 2,